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User's/Programmer's Reference
Volume 1
Core Spectrum Analyzer Functions

ESA Series Spectrum Analyzers

Refer to Volume 2 for one-button power measurements information.

This manual provides documentation for the following instruments:

Agilent Technologies ESA-E Series

E4401B (9 kHz- 1.5 GHz)
E4402B (9 kHz - 3.0 GHz)
E4404B (9 kHz - 6.7 GHz)
E4405B (9 kHz - 13.2 GHz)
E4407B (9 kHz - 26.5 GHz)

Agilent Technologies ESA-L Series

E4411B (9 kHz- 1.5 GHz)
E4403B (9 kHz - 3.0 GHz)
E4408B (9 kHz - 26.5 GHz)

Agilent Technologies

Manufacturing Part Number: E4401-90507
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Safety Information

The following safety symbols are used throughout this manual. Familiarize yourself with the symbols and their meaning before operating this instrument.

WARNING ***Warning*** **denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION *Caution* denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

NOTE *Note* calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

This symbol is used to mark the on position of the power line switch.

This symbol is used to mark the standby position of the power line switch.

This symbol indicates that the input power required is AC.

WARNING **This is a Safety Class 1 Product (provided with a protective earth ground incorporated in the power cord). The mains plug shall be inserted only in a socket outlet provided with a protected earth contact. Any interruption of the**

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protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding may cause product damage.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about Agilent Technologies **ESA** Spectrum Analyzers, including firmware upgrades and application information, please visit the following Internet URL:

http://www.agilent.com/find/esa

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NOTE If the ESA Spectrum Analyzer experiences a rapid “power down / power up” sequence, the analyzer may not have fully powered down. If this occurs, Agilent recommends that you power down the analyzer (using the front-panel power switch) for approximately 10 seconds, then turn the power back on. This will allow the hardware to turn on in the correct state.

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1 Using This Document

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What is in This Book

There are many terms used throughout this book, for example “active function block,” that are explained in detail in the Getting Started guide. It is recommended that you review the Getting Started guide first.

NOTE The front- and rear-panel features, along with the numeric keypad and alpha-numeric softkey fundamentals are described in your Getting Started guide.

Book Organization:

“Front-Panel Key Reference” - provides information about the front-panel and lower-level key functions of your analyzer. This information is organized alphabetically by the front-panel key name. Volume 2 includes the front panel key reference information for all the functions associated with the one-button measurements available when you press the front-panel **MEASURE** key. It also describes all the setup keys associated with each measurement.

“Programming Fundamentals” - provides information on SCPI, C programming language basics, and on using GPIB and RS-232.

“Status Registers” - contains a comprehensive description of status registers explaining what status registers are and how to use them to programatically monitor instrument operation.

“Remote Command Reference” - contains SCPI (Standard Commands for Programmable Instruments) programming commands for the spectrum analyzer. Volume 2 includes the SCPI command information for all the functions associated with the one-button measurements available when you press the front-panel **MEASURE** key. It also describes all the setup commands associated with each measurement.

“Menu Maps” - illustrates the menu structure of the front-panel and lower-level keys. Refer to this chapter to identify the lower-level softkeys associated with the front-panel keys. Volume 2 includes the front panel key reference information for all the functions associated with the one-button measurements available when you press the front-panel **MEASURE** key and It also describes all the setup keys associated with each measurement.

“One-Button Measurement Functions”- are described in Volume 2 of the user/programmer guide. These measurements are selected from those available when you press the front-panel **MEASURE** key, with the default **Spectrum Analysis** Mode selected. Volume 2 provides menu maps, key descriptions, and programming commands for the one-button measurements and all of their associated setup keys and commands.

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2 Front-Panel Key Reference

The front-panel keys in this chapter are listed alphabetically. The lower-level menu keys are arranged as they appear in your analyzer menus. Volume 2 describes all the front-panel key information for the measurements that are available when you press the **MEASURE** key and all their associated setup keys.

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AMPLITUDE Y Scale

Activates the reference level function and accesses the amplitude menu keys. Amplitude menu keys allow you to set functions that affect the way data on the vertical axis is displayed or corrected.

Ref Level

Allows the reference level to be changed. This function is activated when **AMPLITUDE Y Scale** is pressed. The reference level is the amplitude power or voltage represented by the top graticule on the display. Changing the value of the reference level changes the absolute amplitude level (in the selected amplitude units) of the top graticule line. The reference level can be changed using the step keys, the knob, or the numeric keypad. Pressing any digit (0 through 9) on the numeric keypad brings up the terminator menu.

Key Access: **AMPLITUDE / Y Scale**

Attenuation Auto Man

Sets the input attenuation to manual or automatic and allows you to set the attenuation level in 5 dB increments when **Attenuation (Man)** is selected. The analyzer input attenuator, which is normally coupled to the reference level control, reduces the power level of the analyzer input signal at the input mixer. The attenuator is recoupled when **Attenuation (Auto)** is selected. Attenuation can be changed using the step keys, the knob, or the numeric keypad. To select 0 dB, the numeric keypad must be used (except for E4401B or E4411B.)

Key Access: **AMPLITUDE / Y Scale**

CAUTION

To prevent damage to the input mixer, do not exceed a power level of +30 dBm at the input. To prevent signal compression, keep the power at the input mixer below 0 dBm. With the attenuator set to Auto, a signal at or below the reference level will result in a mixer level at or below the **Max Mixer Lvl**.

Scale/Div

Sets the logarithmic units per vertical graticule division on the display. The **Scale/Div** function is only available when the **Scale Type** key is set to **Log**. Scale/Div values may range from 0.1 to 20 dB per division With FM Demod (Option BAA) installed and **Demod View (On)** selected, the range is 1 kHz to 240 kHz/div. With Bluetooth™ FM Demodulation (Option 106) installed and **Demod View (On)** selected, the scale/division is fixed at approximately 40 kHz/division.

Key Access: **AMPLITUDE / Y Scale**

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Scale Type
Log Lin

Scales the vertical graticule divisions in logarithmic units when **Log** is underlined. Logarithmic units may range from 0.1 to 20 dB per division. When **Lin** is underlined, the vertical divisions are linearly scaled and the default amplitude units are volts. The top of the display is set to the reference-level value and the bottom graticule becomes zero volts. (Each division of the graticule is one-tenth of the reference level in volts.) Pressing **Scale Type** always sets the units specified for the current amplitude scale. When **Power On** is set to **Preset** and **Preset Type** is set to **Factory**, pressing **Preset** or powering on the analyzer sets the default units. The fastest sweep time available when **Lin** is selected and the detector is set to average (**Det/Demod**, **Detector**, **Average**) is 8 milliseconds.

Key Access: **AMPLITUDE / Y Scale**

Presel Center

Agilent E4404B, E4405B, E4407B and E4408B only. Adjusts the frequency of the preselector filter (above 2.85 GHz) to optimize the amplitude accuracy at the active marker frequency. With **Input Mixer (Ext)** selected and the Mixer Type set to Presel (preselected), **Presel Center** adjusts the frequency of the external preselector filter to maximize the amplitude at the active marker frequency. If activated in a non-preselected band, **Presel Center** does nothing.

Preselector center should be used to improve amplitude accuracy for signals which fall into any one of the harmonic mixing bands. The harmonic mixing bands Frequency Ranges are:

Band	Frequency Range
1	2.85 - 6.7 GHz
2	6.2 - 13.2 GHz
3	12.8 - 19.2 GHz
4	18.7 - 26.5 GHz

Key Access: **AMPLITUDE / Y Scale**

Presel Adjust

Agilent E4404B, E4405B, E4407B and E4408B only. Allows manual adjustment of the preselector frequency to optimize its response on the signal of interest.

By changing the **Presel Adjust**, the center of the preselector filter can be moved in frequency. The signal of interest will appear to change in amplitude with the frequency response of the preselector filter.

Key Access: **AMPLITUDE / Y Scale**

Y Axis Units

Accesses the menu keys that change the amplitude units. Amplitude units are maintained for both logarithmic and linear modes. The amplitude units can be changed by pressing **dBm**, **dBmV**, **dBµV**, **dBµA, Watts**, **Volts**, and **Amps**. This key is unavailable when **FM Demod** and **Demod View** are on.

Key Access: **AMPLITUDE Y Scale**, **More**

Ref Lvl Offst

Adds an offset value to the displayed reference level. Reference-level offsets are only entered by using the numeric keypad. Entering an offset does not affect the

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trace or the attenuation value. Reference-level offsets are used when gain or loss occurs between a device under test and the analyzer input. Thus, the signal level measured by the analyzer may be referred to as the level at the input of an external amplitude-conversion device. When an amplitude offset is entered, its value appears on the left side of the display under `Offst` (as opposed to frequency offsets which appear at the bottom of the display). To eliminate an offset, press **Ref Lvl Offst**, **0**, **dB**. When **Preset Type** is set to **Factory**, pressing **Preset** also sets the offset to zero. See also the **Ext Amp Gain** key description.

Key Access: **AMPLITUDE Y Scale**, **More**

Int Preamp On Off

Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B) with Option 1DS. Turns the internal preamp on and off. Pressing **Int Preamp (On)** results in a correction being applied to compensate for the gain of the preamp so that amplitude readings show the value at the input connector. When the preamp is on, a `PA` indication appears on the left side of the display. The preamp is switched off in frequency bands above 3 GHz and the correction is not applied. In this case, the `PA` indication will still appear even though the preamp is not activated.

The preamp is specified to operate over a 1 MHz to 3 GHz range for the E4402B, E4404B, E4405B and E4407B. The preamp range for the E4401B is 100 kHz to 1.5 GHz, except for Option 1DP, which is 1 MHz to 1.5 GHz.

Key Access: **AMPLITUDE Y Scale**, **More**

Corrections

Accesses the **Corrections** menu keys which allow you to enable the corrections function and to select which set of correction factors you wish to modify.

Key Access: **AMPLITUDE Y Scale**, **More**

Apply Corrections
Yes No

Pressing **Apply Corrections (Yes)** turns on the amplitude-correction factors. Corrections will only be applied to the sets of correction factors whose correction state is set to On. To turn a set of correction factors on, use the **Correction On Off** key in the Antenna, Cable, Other, or User menus. When **Apply Corrections (Yes)** is selected, an `A` will appear on the screen annotation whether or not a correction set has been turned on using the **Correction (On)** key in the Antenna, Cable, Other, or User menus.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Antenna

Accesses the Antenna menu of keys which allow you to correct for antenna loss, but may be used for any kind of correction.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Correction On Off

Turns the amplitude correction function on or off for the selected set. The corrections state must be set to On for the correction to be applied.

Key Access: **AMPLITUDE / Y Scale**, **More**,

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Corrections, **Antenna**

NOTE Antenna, Cable, and Other correction factors are generally entered as positive values. This indicates a loss in the external device. User correction factors are typically entered as negative values which indicate a gain in the external device.

Edit

Accesses menu keys that allow you to create and edit an amplitude-correction factor set. It puts the analyzer into a split-screen mode where the correction data is displayed in a table under the trace data. Pressing **ESC** while in this menu will exit the menu and remove the table from the screen. New points will be applied only after the editor is closed. The Tab keys are very useful for navigation between rows in the corrections table.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Antenna**

Point

Allows you to create or edit an amplitude-correction factor data point. Up to 200 points may be defined for each set. Enter the point number to be created or edited by using the numeric keypad, then press **Enter**, or use the knob, tab, or step keys to move to an existing point. Press **Bk Sp** to correct errors. After selecting a point, **Frequency** becomes active.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Antenna**, **Edit**

Frequency

Allows you to enter the frequency value for an amplitude-correction point. Enter the frequency value by using the numeric keypad. Change the frequency value by using the step keys or the knob. Press **Bk Sp** to correct errors. After selecting a point, **Amplitude** becomes active.

A frequency coordinate must always be specified for amplitude-correction factors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Antenna**, **Edit**

NOTE The amplitude correction entered for the lowest frequency will be applied to all

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frequencies less than the lowest frequency entered. Similarly, the amplitude correction for the highest frequency entered will be applied to all frequencies greater than the highest frequency entered.

NOTE For amplitude-correction factors, a maximum of two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; any middle points are ignored.

NOTE Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

Amplitude

Allows you to enter the amplitude value for the current amplitude-correction point. After selecting a point, the point number automatically increments and **Frequency** becomes active to allow entry of the frequency of the next point. Press **Bk Sp** to correct errors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Antenna**, **Edit**

Delete Point

Allows you to delete the amplitude-correction data for the currently selected point. The prompt **I**`f you are sure, press key again to delete` will appear on the display. Pressing **Delete Point** again will delete the point and adjust all of the point numbers as appropriate.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Antenna**, **Edit**

Delete Correction Allows you to clear all data from the selected amplitude-correction set. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete** again will delete the correction set.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **Antenna**

Cable Allows you to correct for cable loss, but may be used for any kind of correction.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Correction On Off Turns the amplitude correction function on

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or off for the selected set. The corrections state must be set to On for the correction to be applied.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**, **Cable**

NOTE Antenna, Cable, and Other correction factors are generally entered as positive values. This indicates a loss in the external device. User correction factors are typically entered as negative values which indicate a gain in the external device.

Edit

Accesses menu keys that allow you to create and edit an amplitude-correction factor set. It puts the analyzer into a split-screen mode where the correction data is displayed in a table under the trace data. Pressing **ESC** while in this menu will exit the menu and remove the table from the screen. New points will be applied only after the editor is closed. The Tab keys are very useful for navigation between rows in the corrections table.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Cable**

Point

Allows you to create or edit an amplitude-correction factor data point. Up to 200 points may be defined for each set. Enter the point number to be created or edited by using the numeric keypad, then press **Enter**, or use the knob, tab, or step keys to move to an existing point. Press **Bk Sp** to correct errors. After selecting a point, **Frequency** becomes active.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Cable**, **Edit**

Frequency

Allows you to enter the frequency value for an amplitude-correction point. Enter the frequency value by using the numeric keypad. Change the frequency value by using the step keys or the knob. Press **Bk Sp** to correct errors. After selecting a point, **Amplitude** becomes active.

A frequency coordinate must always be specified for amplitude-correction factors.

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Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Cable**, **Edit**

NOTE The amplitude correction entered for the lowest frequency will be applied to all frequencies less than the lowest frequency entered. Similarly, the amplitude correction for the highest frequency entered will be applied to all frequencies greater than the highest frequency entered.

NOTE For amplitude-correction factors, a maximum of two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; any middle points are ignored.

NOTE Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

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Amplitude

Allows you to enter the amplitude value for the current amplitude-correction point. After selecting a point, the point number automatically increments and **Frequency** becomes active to allow entry of the frequency of the next point. Press **Bk Sp** to correct errors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Cable**, **Edit**

Delete Point

Allows you to delete the amplitude-correction data for the currently selected point. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete Point** again will delete the point and adjust all of the point numbers as appropriate.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Cable**, **Edit**

Delete Correction Allows you to clear all data from the selected amplitude-correction set. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete** again will delete the correction set.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **Cable**

Other Allows you to correct for gain or loss other than for antenna, cable, or user.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Correction On Off Turns the amplitude correction function on or off for the selected set. The corrections state must be set to On for the correction to be applied.

Key Access: Amplitude Y Scale, More, Corrections, Other

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NOTE Antenna, Cable, and Other correction factors are generally entered as positive values. This indicates a loss in the external device. User correction factors are typically entered as negative values which indicate a gain in the external device.

Edit

Accesses menu keys that allow you to create and edit an amplitude-correction factor set. It puts the analyzer into a split-screen mode where the correction data is displayed in a table under the trace data. Pressing **ESC** while in this menu will exit the menu and remove the table from the screen. New points will be applied only after the editor is closed. The Tab keys are very useful for navigation between rows in the corrections table.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Other**

Point

Allows you to create or edit an amplitude-correction factor data point. Up to 200 points may be defined for each set. Enter the point number to be created or edited by using the numeric keypad, then press **Enter**, or use the knob, tab, or step keys to move to an existing point. Press **Bk Sp** to correct errors. After selecting a point, **Frequency** becomes active.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Other**, **Edit**

Frequency

Allows you to enter the frequency value for an amplitude-correction point. Enter the frequency value by using the numeric keypad. Change the frequency value by using the step keys or the knob. Press **Bk Sp** to correct errors. After selecting a point, **Amplitude** becomes active.

A frequency coordinate must always be specified for amplitude-correction factors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Other**, **Edit**

NOTE The amplitude correction entered for the lowest frequency will be applied to all frequencies less than the lowest frequency entered. Similarly, the amplitude

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correction for the highest frequency entered will be applied to all frequencies greater than the highest frequency entered.

NOTE For amplitude-correction factors, a maximum of two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; any middle points are ignored.

NOTE Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

Amplitude

Allows you to enter the amplitude value for the current amplitude-correction point. After selecting a point, the point number automatically increments and **Frequency** becomes active to allow entry of the frequency of the next point. Press **Bk Sp** to correct errors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Other**, **Edit**

Delete Point

Allows you to delete the amplitude-correction data for the currently selected point. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete Point** again will delete the point and adjust all of the point numbers as appropriate.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **Other**, **Edit**

Delete Correction Allows you to clear all data from the selected amplitude-correction set. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete** again will delete the correction set.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **Other**

User Allows you to correct for gain or loss and may be used for any type of correction.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**

Correction On Off Turns the amplitude correction function on or off for the selected set. The corrections state must be set to On for the correction to be

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applied.

Key Access: **AMPLITUDE / Y Scale**, **More**, **Corrections**, **User**

NOTE Antenna, Cable, and Other correction factors are generally entered as positive values. This indicates a loss in the external device. User correction factors are typically entered as negative values which indicate a gain in the external device.

Edit

Accesses menu keys that allow you to create and edit an amplitude-correction factor set. It puts the analyzer into a split-screen mode where the correction data is displayed in a table under the trace data. Pressing **ESC** while in this menu will exit the menu and remove the table from the screen. New points will be applied only after the editor is closed. The Tab keys are very useful for navigation between rows in the corrections table.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **User**

Point

Allows you to create or edit an amplitude-correction factor data point. Up to 200 points may be defined for each set. Enter the point number to be created or edited by using the numeric keypad, then press **Enter**, or use the knob, tab, or step keys to move to an existing point. Press **Bk Sp** to correct errors. After selecting a point, **Frequency** becomes active.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **User**, **Edit**

Frequency

Allows you to enter the frequency value for an amplitude-correction point. Enter the frequency value by using the numeric keypad. Change the frequency value by using the step keys or the knob. Press **Bk Sp** to correct errors. After selecting a point, **Amplitude** becomes active.

A frequency coordinate must always be specified for amplitude-correction factors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **User**, **Edit**

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NOTE The amplitude correction entered for the lowest frequency will be applied to all frequencies less than the lowest frequency entered. Similarly, the amplitude correction for the highest frequency entered will be applied to all frequencies greater than the highest frequency entered.

NOTE For amplitude-correction factors, a maximum of two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; any middle points are ignored.

NOTE Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

Amplitude

Allows you to enter the amplitude value for the current amplitude-correction point. After selecting a point, the point number automatically increments and **Frequency** becomes active to allow entry of the frequency of the next point. Press **Bk Sp** to correct errors.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **User**, **Edit**

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Delete Point

Allows you to delete the amplitude-correction data for the currently selected point. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete Point** again will delete the point and adjust all of the point numbers as appropriate.

Key Access: **AMPLITUDE Y Scale**, **More, Corrections**, **User**, **Edit**

Delete Correction Allows you to clear all data from the selected amplitude-correction set. The prompt `If you are sure, press key again to delete` will appear on the display. Pressing **Delete** again will delete the correction set.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **User**

Freq Interp
Log Lin Allows you to determine how trace values are computed between points in a correction table. If the linear mode is selected, a straight line is used between points in a correction table. If the logarithmic mode is selected, frequency values between points are computed by first taking the logarithm of both table values and the intermediate value.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **More**

Delete all Corrections Allows you to delete all amplitude-correction sets.

Key Access: **AMPLITUDE Y Scale**, **More**, **Corrections**, **More**

Ext Amp Gain Adds a positive or negative preamplifier gain value, which is subtracted from the displayed signal. (Use negative values for gain and positive values for loss.) The function is similar to the **Ref Lvl Offset** function. With the **Ext Amp Gain** function, the attenuation may be changed depending on the preamplifier gain entered. A preamplifier gain offset is used for measurements that require an external preamplifier or long cables. The offset is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the input of the preamplifier. The preamplifier gain offset is displayed at the top of the screen and is removed by entering zero. The preamplifier gain offset can only be entered using the numeric keypad. The preamplifier gain value is not affected by an instrument preset or a power cycle.

Key Access: **AMPLITUDE Y Scale**, **More**

Max Mixer Lvl Allows you to change the maximum input mixer level from 10 dBm to –100 dBm in 10 dB steps using the step keys, and 1 dB steps using the knob. In addition, you may use the keypad to specify a value. The mixer level is equal to the reference

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level minus the attenuator setting. As the reference level changes, the input attenuator setting is changed to keep the power levels of on-screen signals less than the selected level at the input mixer. When **Preset Type** is set to **Factory**, pressing **Preset** resets the maximum input mixer level to –10 dBm.

Key Access: **AMPLITUDE Y Scale**, **More**

IF Gain Auto Fixed

When using digital resolution bandwidths (RBW < 1 kHz), the analyzer uses IF Gain autoranging to set the optimum signal gain for digital processing. This technique produces the maximum measurement range without overloading the digital system. To increase measurement speed, select **IF Gain (Fixed)**. This setting decreases the display range to 70 dB, so you may have to adjust the reference level to ensure complete view of the signal.

Key Access: **Amplitude**, **More**, **More**

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Auto Couple

Accesses the menus to couple functions in your analyzer. Coupled functions are functions that are linked.

Auto All

Auto-couples all coupled functions. If **Auto All** is pressed all coupled functions are set to **Auto**.

NOTE

This function is not available when the segmented sweep function is set to On, **(Segmented (On)**).

Coupled functions are functions that are linked. If one function is changed, the coupled function is changed. During normal operation, the sweep time, resolution bandwidth, video bandwidth, and center frequency step are coupled to span; the input attenuation is coupled to the reference level.

If any of these functions become uncoupled (is set to manual), a # sign appears next to the screen annotation representing the function on the screen. If one or more functions are manually set so that the amplitude or frequency becomes uncalibrated “Meas Uncal” appears on the top right side of the graticule.

To recouple the analyzer functions, the uncoupled function(s) must be individually set back to Auto. Or, you can press **Auto All** to return all of the functions to their default auto state. Pressing **Auto All** will couple the following functions:

- Sweep time will couple to the span, detector mode, resolution bandwidth, and video bandwidth.
- **Detector (Auto)** is set.
- **Avg Type (Auto)** is set.
- **PHNoise Opt (Auto)** is set.
- RF attenuation couples to reference level.
- Center frequency step size will couple to 10% of span.
- Sweep coupling (SR/SA) will couple back to SA mode.
- Source attenuation couples to source amplitude.
- Source power step couples to one vertical scale division.

Key Access: **Auto Couple**

NOTE

Although **Marker Count**, **Gate Time**, and **Marker Trace** have **Auto** settings, they are not affected by **Auto All**.

PhNoise Opt
Auto Man

Chooses the LO (local oscillator) phase noise behavior that is optimum for measurement accuracy.

Key Access: Auto Couple

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Auto Allows the analyzer to automatically select an LO phase noise behavior that is optimum for the selected span and RBW. The **Auto** rules choose **Fast Tuning** whenever the span is >10 MHz otherwise the **Auto** rules choose **Optimize £(f)**.

Key Access: **Auto Couple, PhNoise Opt Auto Man**

Optimize £(f) Optimizes for LO phase noise.

Key Access: **Auto Couple, PhNoise Opt Auto Man**

Optimize LO for Fast Tuning The LO behavior compromises phase noise within approximately 10 MHz of the carrier. This allows rapid measurement throughput when changing the center frequency or span.

Key Access: **Auto Couple, PhNoise Opt Auto Man**

Detector Auto Man Selects a specific detector, or in **Auto**, picks the appropriate detector for a particular measurement.

When discussing detectors, it is important to understand the concept of a trace "bucket." For every trace point displayed, there is a finite time during which the data for that point is collected. The analyzer has the ability to look at all of the data collected during that time and present a single point of trace data based on the detector mode. We call the interval during which the data for that trace point is being collected, the "bucket." Thus a trace is more than a series of single points. It is actually a series of trace "buckets." The data may be sampled many times within each bucket.

Selecting **Detector (Auto)** and **BW/Avg**, **Average (On)** changes the detector. The **Auto** choice depends on marker functions, trace functions, and the trace averaging function. If a marker function or measurement is running, the **Auto** choice of detector is either **Average** or **Sample**. When one of the detectors (such as **Average**) is manually selected instead of **Auto**, that detector is used regardless of other analyzer settings.

The **Average** detector displays the average of the signal within the bucket. The averaging method depends upon **Avg Type** selection (Video or RMS). When the **Average** detector is selected and the amplitude scale is linear, the fastest sweet time is 8 milliseconds.

The **Peak** detector displays the maximum of the signal within the bucket.

The **Sample** detector displays the instantaneous level of the signal at the time of the sampling.

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The **Negative Peak** detector displays the minimum of the signal within the bucket.

Neither average nor sample detectors measure amplitudes of CW signals as accurately as peak, because they may not find a spectral component's true peak, but they do measure noise without the biases of peak detection.

The detector in use is indicated on the left side of the display. A # will appear next to it if the detector has been manually selected.

Key Access: **Auto Couple**

Auto The system selects peak detection as the default, but if a condition arises where a different type of detection scheme provides greater accuracy, the system will use the alternate scheme. For example, when using the Marker Noise function, Auto mode selects Average detection for Res BWs > 300 Hz and Sample for Res BWs ≤ 300 Hz as shown in Figure 2-1.

Key Access: **Auto Couple, Detector Auto Man**

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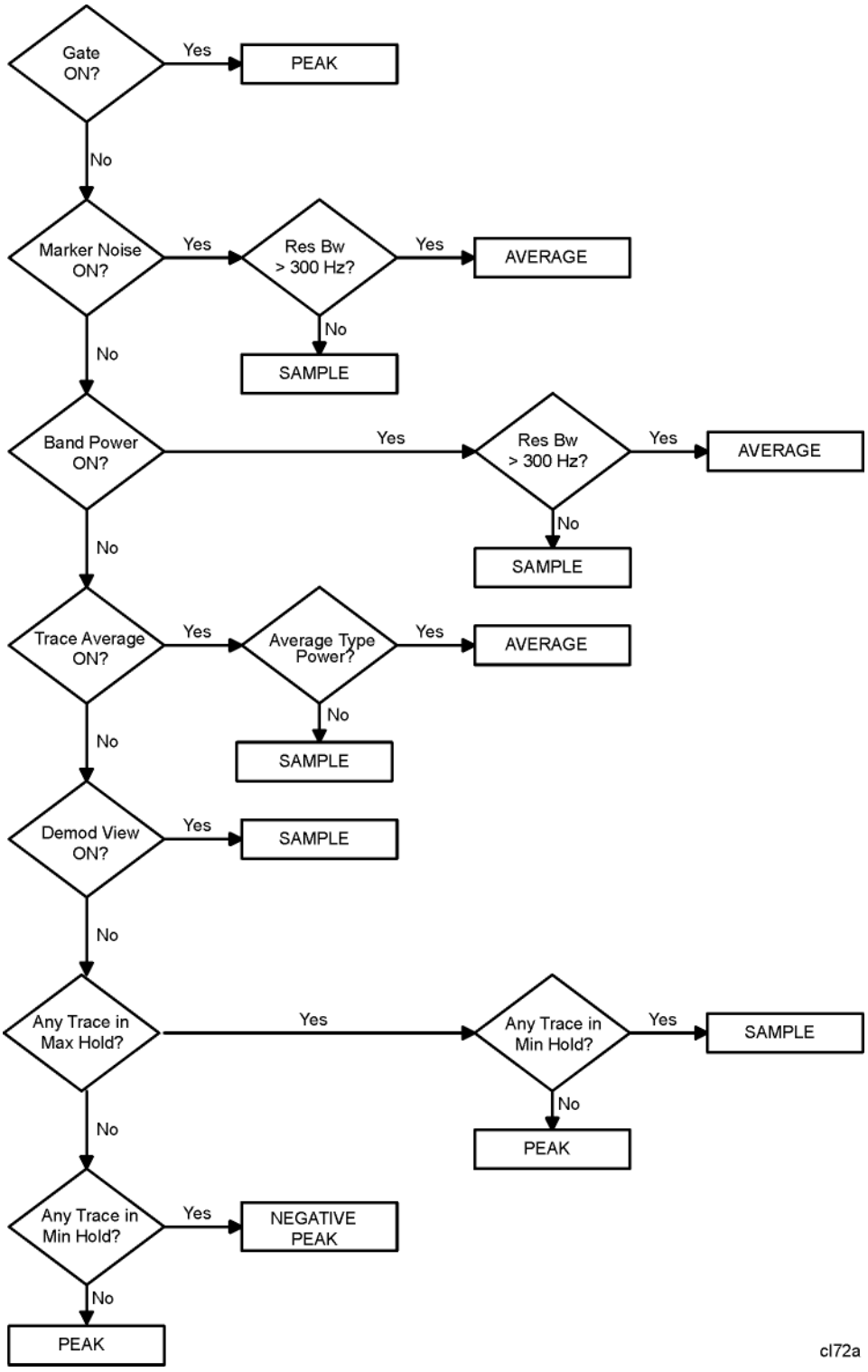
Figure 2-1 Detector (Auto) Selection Flowchart



Average Allows you to select between video and power (RMS) averaging, via the **Average Type** key.

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Average detection is used when measuring the average value of the amplitude across each trace interval (bucket). The averaging method used by the Average detector will be set to either Video or Power as appropriate when the Average Type is Auto coupled or may be set explicitly through the **BW/Avg**, **Avg Type Auto Man** key.

Video Average detection computes the averaged trace interval as appropriate to the Y-axis scale:

- Log-power average when in log scale.
- Voltage average when in linear scale.
- Frequency deviation when Demod View is enabled for FM Demod.

Power Average ("root mean square" or RMS) detection computes the RMS of the samples collected across the trace interval. The number of samples included in the RMS average for each trace interval depends on the sweep time, the resolution bandwidth, and whether or not option B7D is installed. With option B7D installed, more samples are available as appropriate for wider resolution bandwidths and faster sweep times. Slower sweep times also increase the number of samples averaged for each trace interval.

When **Average** is selected, `Avg` appears on the left side of the display.

NOTE When the **Average** detector is selected in linear amplitude scale mode, the fastest sweet time is 8 milliseconds.

Key Access: **Auto Couple, Detector Auto Man**

Peak Peak detection is used primarily when measuring sinusoidal (spectral) components. Peak detection obtains the maximum video signal value between the last display point and the present display point and stores this value in memory. When **Preset Type** is set to **Factory**, peak detection is selected at power on and by pressing **Preset**. When **Peak** detection is selected, **`Peak`** appears in the upper-left corner of the display.

Key Access: **Auto Couple, Detector Auto Man**

Sample Sample detection is used primarily to display noise or noise-like signals. This detection should not be used to make the most accurate amplitude measurement of non noise-like signals. In sample mode, the instantaneous signal value at the present display point is placed in memory. When **Sample** detection is selected, **`Samp`** appears in the upper-left corner of the display.

Key Access: **Auto Couple, Detector Auto Man**

Negative Peak Negative peak detection functions the same as peak detection,

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but selects the minimum video signal value. This detection should not be used to make the most accurate amplitude measurements of signals. When **Negative Peak** is selected, `NPeak` appears in the upper-left corner of the screen.

Key Access: **Auto Couple, Detector Auto Man**

Avg Type Auto Man

Accesses the functions to automatically or manually choose from one of the following averaging scales: Video or Power (RMS).

NOTE

If video averaging is selected, the measurement results are the average of the signal level in the y-axis scale. If the power average (RMS) is selected, all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. The main point to remember is that there can be significant differences between the average of the log of power and the log of the average power.

There are actually four types of averaging processes within a spectrum analyzer. All, except VBW filtering, are affected by this setting. They are:

- Trace averaging (see **BW/Avg**, **Average (On)**).

  Averages signal amplitudes on a trace-to-trace basis. (The type of averaging (Video or Power (RMS)) is selected by pressing **BW/Avg**, **Avg Type**.)

- Average detector (see **Det/Demod**, **Detector, Average (Video/RMS)**).

  Averages signal amplitudes during the time or frequency interval represented by a particular measurement point. The method is determined by selection of either Video or RMS.

- Noise Marker (see **Marker**, **Noise**)

  Averages signal amplitudes across measurement points to reduce variations for noisy signals.

- VBW filtering.

  Filtering the video is a form of averaging the video signal.

When trace average is on (**BW/Avg**, **Average (On)**, the Average Type is shown on the left side of the display. When **Avg Type (Auto)** is selected, the analyzer chooses the type of averaging to be used as shown in Figure 2-2. When one of the average types is selected manually, the analyzer uses that type without regard to the other analyzer settings and sets **Avg Type** to **Man**.

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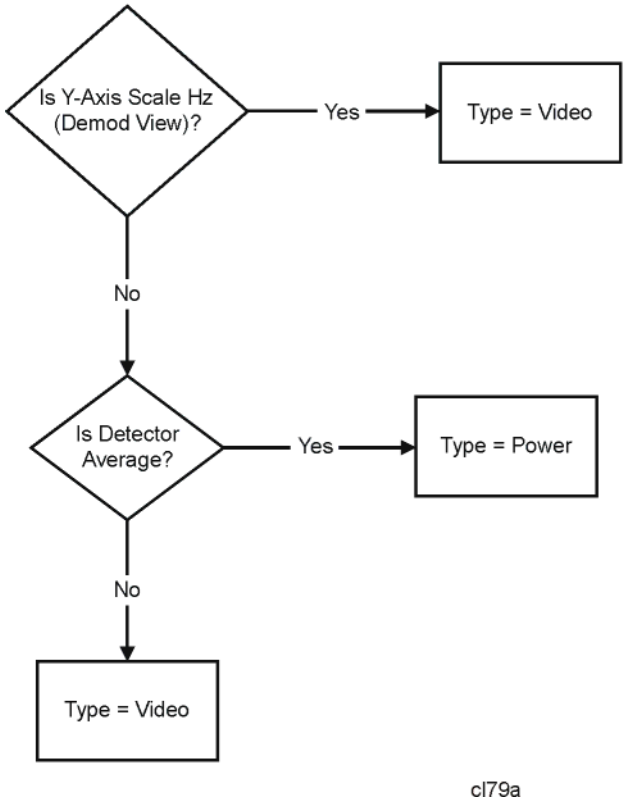
Figure 2-2 Auto Rules for Average Type



Key Access: **Auto Couple**

Video Avg Video averaging averages the data as appropriate for the y-axis scale. When **Avg Type**, **Video Avg** is selected, **`VAvg`** appears on the left side of the analyzer display if **Average** is On.

Key Access: **Auto Couple**, **Avg Type**

Pwr Avg Power averaging is performed by converting the trace data from logarithmic to linear power units, and then averaging the power trace data. When **Avg Type**, **Pwr Avg** is selected, **`PAvg`** appears on the left side of the analyzer display if **Average** is On.

Key Access: **Auto Couple**, **Avg Type**

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Bk Sp (Backspace)

The backspace key is located on the front panel and is used to change or correct an active function entry or a text entry before you save to a file.

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BW/Avg

Activates the resolution bandwidth function and accesses the menu keys that control the bandwidth functions and averaging.

Res BW
Auto Man

Changes the 3 dB resolution bandwidth on the analyzer from 1 kHz to 5 MHz in a 1, 3, 10 sequence using the knob or step keys. If an unavailable bandwidth is entered using the numeric keypad, the closest available bandwidth in the 1, 3, 10 sequence is used. (For ESA-E Series analyses, Option 1DR provides additional 300 Hz, 200 Hz, 100 Hz, 30 Hz and 10 Hz bandwidths. For firmware revision A.08.00 and later, the bandwidth range is from 1 Hz to 5 MHz if you have both Options 1D5 and 1DR.) (For ESA-L Series analyses, Option 1DR provides additional 300 Hz, 200 Hz, and 100 Hz bandwidths.) As the resolution bandwidth is decreased, the sweep time is modified to maintain amplitude calibration. Resolution bandwidth is also related to span. As span is decreased, the resolution bandwidth is decreased. As the resolution bandwidth changes, the video bandwidth, if in auto couple mode, changes to maintain the VBW/RBW ratio.

NOTE

With firmware A.08.00 and greater, in zero span, the auto/manual function of this key is not applicable. When **Res BW (Auto)** is selected in non-zero span, any changes to Res BW while in zero span will revert to the Auto value when you return to non-zero span. When **Res BW (Man)** is selected in non-zero span, any changes to Res BW while in zero span will be maintained when you return to non-zero span.

A "#" mark appears next to `Res BW` on the display when it is not coupled. To recouple the resolution bandwidth, press **Res BW (Auto)** (or press **Auto Couple, Auto All**). The resolution bandwidth can be changed using the step keys, the knob, or the numeric keypad.

Key Access: **BW/Avg**

Video BW
Auto Man

Changes the analyzer post-detection filter from 30 Hz to 3 MHz in a 1, 3, 10 sequence using the knob, step keys, or the numeric keypad. If an unavailable bandwidth is entered using the numeric keypad, the closest available bandwidth in the 1, 3, 10 sequence is used. (Option 1DR provides additional 1 Hz, 3 Hz and 10 Hz video bandwidths when the resolution bandwidth is ≤ 300 Hz.)

As the video bandwidth is decreased, the sweep time is increased to maintain amplitude calibration. A "#" mark appears next to VBW on the bottom of the analyzer display when it is not coupled. To couple the video bandwidth, press **Video BW (Auto)** (or press **Auto All**).

Key Access: **BW/Avg**

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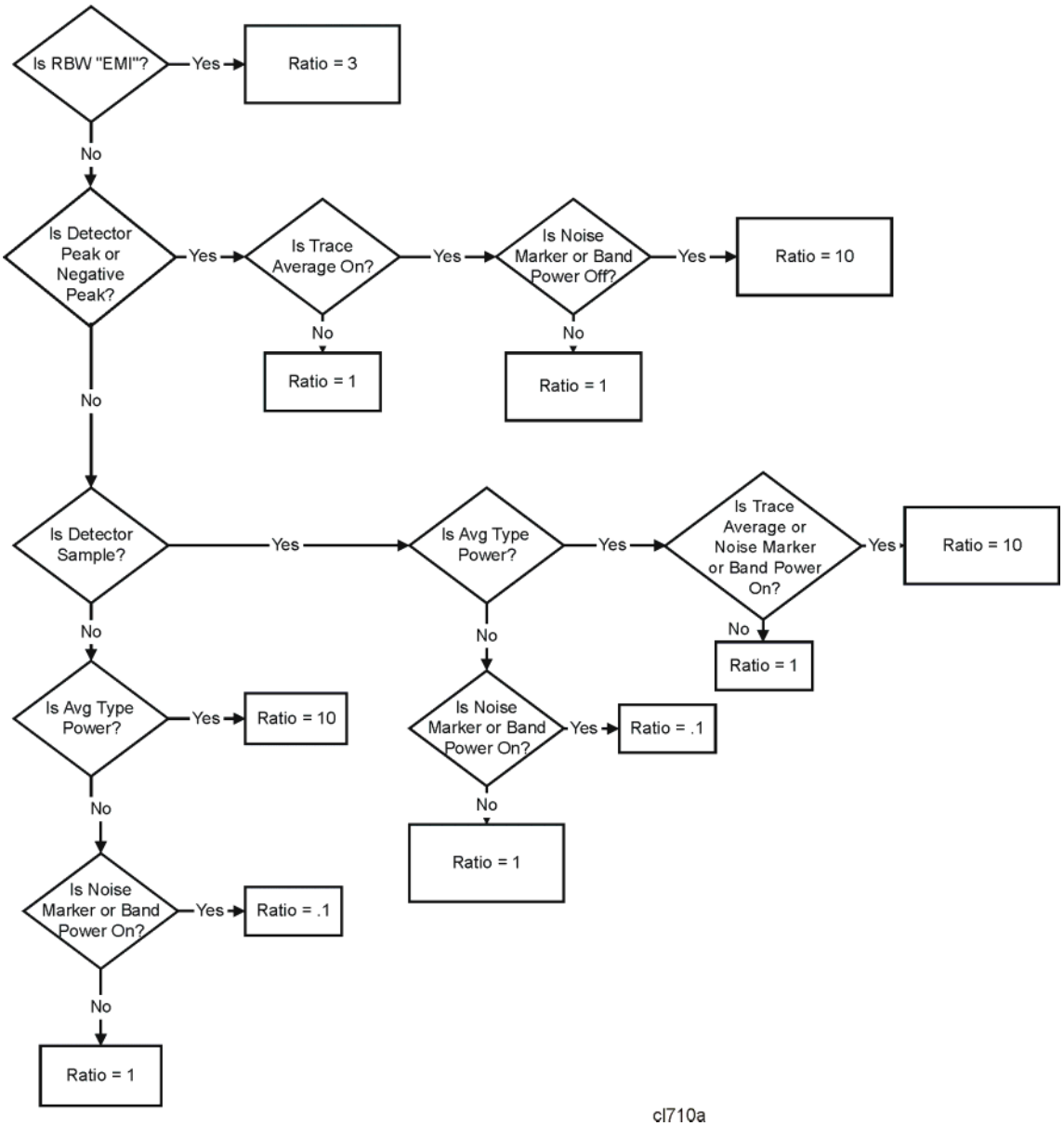
VBW/RBW Auto Man

Selects the ratio between the video and resolution bandwidths. If signal responses near the noise level are visually masked by the noise, the ratio can be set to less than 1 to lower the noise. The knob and step keys change the ratio in a 1, 3, 10 sequence. When **Preset Type** is set to **Factory** and **Preset** is pressed or **Auto Couple**, **Auto All** have been selected, the ratio is set to 1.000 X. The ratio can be changed using the step keys, knob, or numeric keypad. When **VBW/RBW (Auto)** is selected, the ratio is determined by the rules in Figure 2-3.

Figure 2-3 VBW/RBW Ratio Auto Rules



Key Access: **BW/Avg**

Average On Off

Initiates a digital averaging routine that averages the trace points in a number of successive sweeps resulting in trace “smoothing”. The number of sweeps (average

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number) can be selected. Increasing the average number will further smooth the trace. The type of averaging used is selected by pressing **BW/Avg, Avg Type**.

The average is restarted when any of the following occurs:

- a new average number is entered.
- any measurement related parameter (e.g., Center Frequency) is changed.
- **Restart** is pressed.
- **Single Sweep** is pressed.

When in Single Sweep, the specified number of averages is taken, then the sweep stops. When in continuous sweep, the specified number of averages is taken, then the averaging continues with each new sweep averaged in with a weight of $\frac{1}{\text{Average Number}}$ and the old average reduced by multiplying it by $\left(\text{Average Number} - \frac{1}{\text{Average Number}}\right)$.

To turn off averaging, press **Average (Off)**. The number of sweeps can only be entered using the numeric keypad, not the knob or step keys.

Key Access: **BW/Avg**

Avg Type
Auto Man

Accesses the functions to automatically or manually choose from one of the following averaging scales: Video or Power (RMS).

NOTE

If video averaging is selected, the measurement results are the average of the signal level in the y-axis scale. If the power average (RMS) is selected, all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. The main point to remember is that there can be significant differences between the average of the log of power and the log of the average power.

There are actually four types of averaging processes within a spectrum analyzer. All, except VBW filtering, are affected by this setting. They are:

- Trace averaging (see **BW/Avg**).

  Averages signal amplitudes on a trace-to-trace basis. (Press Video or Power (RMS) when **Avg Type (Man)** is selected.)

- Average detector (see **Detector**, **Average**).

  Averages signal amplitudes during the time or frequency interval represented by a particular measurement point.

- Noise Marker (see **Marker**, **Noise**)

  Averages signal amplitudes across measurement points to reduce variations for noisy signals.

- VBW filtering.

  Filtering the video is a form of averaging the video signal.

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When trace average is on (**BW/Avg**, **Average (On)**, the Average Type is shown on the left side of the display. When **Avg Type (Auto)** is selected, the analyzer chooses the type of averaging to be used as shown in Figure 2-2 on page 58. When one of the average types is selected manually, the analyzer uses that type without regard to the other analyzer settings and sets **Avg Type** to **Man**.

Key Access: **BW/Avg**

Video Avg Video averaging averages the data as appropriate for the y-axis scale. When **Avg Type**, **Video Avg** is selected, `VAvg` appears on the left side of the analyzer display if **Average** is On.

Key Access: **BW/Avg**, **Avg Type**

Pwr Avg Power averaging is performed by converting the trace data from logarithmic to linear power units, and then averaging the power trace data. When **Avg Type**, **Pwr Avg** is selected, `PAvg` appears on the left side of the analyzer display if **Average** is On.

Key Access: **BW/Avg**, **Avg Type**

EMI Res BW Accesses the **EMI Res BW** menu keys and allows you to choose between 6 dB bandwidths of **120 kHz**, **9 kHz** and **200 Hz**. The 200 Hz bandwidth is only available if Option 1DR (narrow resolution bandwidth) is installed and the span is less than 5 MHz.

This function is set to **None** when the resolution bandwidth is set to any other value using the **Resolution BW** key.

Key Access: **BW/Avg**

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Det/Demod

Accesses the menu keys controlling detector functions, demodulation functions, and the speaker. FM demod is available with options 106, BAA or AYQ installed.

NOTE The FM Demod internal circuitry must be aligned before use. Press **System**, **Alignments**, **Align Now**, **FM Demod**.

Detector Auto Man Selects a specific detector, or uses the system to pick the appropriate detector (through **Auto**) for a particular measurement.

When discussing detectors, it is important to understand the concept of a trace "bucket." For every trace point displayed, there is a finite time during which the data for that point is collected. The analyzer has the ability to look at all of the data collected during that time and present a single point of trace data based on the detector mode. We call the interval during which the data for that trace point is being collected, the "bucket." Thus a trace is more than a series of single points. It is actually a series of trace "buckets." The data may be sampled many times within each bucket.

When the detector choice is **Auto**, selecting trace averaging (**BW/Avg**, **Average (On)**) changes the detector. The **Auto** choice depends on marker functions, trace functions, and the trace averaging function. If a marker function or measurement is running, the **Auto** choice of detector is either **Average** or **Sample**. When one of the detectors (such as **Average**) is manually selected instead of **Auto**, that detector is used without regard to other analyzer settings.

- Average - displays the average of the signal within the display bucket. Set the averaging method with **Avg Type** (Video or RMS).
- Sample - displays the instantaneous level of the signal at the center of the bucket represented by each display point.
- Peak - displays the maximum of the signal within the bucket.
- Negative Peak - displays the minimum of the signal within the bucket.

Neither average nor sample detectors measure amplitudes of CW signals as accurately as peak, because they may not find a spectral component's true peak. However, they both measure noise better without the positive bias of peak detection.

The detector in use is indicated on the left side of the display. A # will appear next to it if the detector has been manually selected.

Key Access: **Det/Demod**

Auto The system selects peak detection as the default. If a measurement condition arises where a different type of detection scheme would be better utilized, the system will use the alternate scheme. For example, the Marker Noise function

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uses Average detection when in Auto mode because the system determines that the data will be more accurate for noise-type signals. Refer to Figure 2-1 on page 55 for more information.

Key Access: **Det/Demod, Detector Auto Man**

Average

Average detection measures the average value of the amplitude across each trace interval (bucket). The averaging method will be set to either Video or Power as appropriate when the Average Type is Auto coupled, or it may be set explicitly with the **BW/Avg**, **Avg Type Auto Man** key.

Video Average detection computes the averaged trace interval as appropriate to the Y-axis scale:

- Log-power average when in log scale.
- Voltage average when in linear scale.
- Frequency deviation when Demod View is enabled for FM Demod.

Power Average (“root mean square” or RMS) detection computes the RMS of the samples collected across the trace interval. The number of samples included in the RMS average for each trace interval depends on the sweep time, the resolution bandwidth, and whether or not option B7D is installed. With option B7D installed, more samples are available as appropriate for wider resolution bandwidths and faster sweep times. Slower sweep times also increase the number of samples averaged for each trace interval.

When **Average** is selected, `Avg` appears on the left side of the display.

NOTE When the **Average** detector is selected and the amplitude scale is linear, the fastest sweet time is 8 milliseconds.

Key Access: **Det/Demod, Detector Auto Man**

Peak

Peak detection is used primarily when measuring sinusoidal (spectral) components. Peak detection obtains the maximum video signal value between the last display point and the present display point and stores this value in memory. Peak detection is selected at power on and by pressing **Preset** when **Preset Type** is set to **Factory** and **Power On** is set to **Preset**. When **Peak** detection is selected, **`Peak`** appears in the upper-left corner of the display.

Key Access: **Det/Demod, Detector Auto Man**

Sample

Sample detection is used primarily to display noise or noise-like

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signals. This detection should not be used to make the most accurate amplitude measurement of non noise-like signals. In sample mode, the instantaneous signal value at the present display point is placed in memory. When **Sample** detection is selected, **Samp** appears in the upper-left corner of the display.

Key Access: **Det/Demod, Detector Auto Man**

Negative Peak Negative peak detection functions the same as peak detection, but selects the minimum video signal value. This detection should not be used to make the most accurate amplitude measurements of signals. When **Negative Peak** is selected, **NPk** appears in the upper-left corner of the screen.

Key Access: **Det/Demod, Detector Auto Man**

EMI Detector Selects and configures the specified type of EMI detection. Selecting either quasi-peak or EMI average runs an amplitude ranging process that affects the reference level and attenuation settings. This optimizes the available dynamic range for the measurement. It also gives you access to the View and QP/Avg Gain functions.

Key Access: **Det/Demod**

NOTE The **EMI Detector** menu key only appears when the Option AYQ is installed.

Quasi Peak The quasi-peak EMI detector weights the peak detected amplitude using specific charge, discharge, and meter time constants. The effect of this detector depends on the characteristics and repetition rate of the input signal. When the quasi-peak detector is selected, the analyzer is forced to linear amplitude display using sample detection.

Key Access: **Det/Demod, EMI Detector**

EMI Average The EMI average detector averages the peak detected amplitude. When EMI average detection is selected, the analyzer is forced to linear amplitude display using sample detection.

Key Access: **Det/Demod, EMI Detector**

Off Turning EMI detectors off restores the amplitude reference level and scale type (logarithmic or linear) that was used prior to the selection of either the quasi-peak or average detector. It also turns off any special ranging and grays out the **View** and **QP/Avg Gain** keys.

Key Access: **Det/Demod, EMI Detector**

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View

Selects between peak detection and quasi-peak/EMI average detection, without changing the ranging which adjusts the reference level. This allows you to use peak detection while maintaining the current EMI measurement view/settings. This function is not available unless you have selected either **Quasi Peak** or **EMI Average**.

When **Pk** is selected, the peak detector is used and the quasi peak and EMI average detectors are bypassed. When **QP/Avg** is selected the quasi peak or EMI average detector is used and the analyzer is forced to linear amplitude detection mode using sample detection.

Key Access: **Det/Demod, EMI Detector**

QP/Avg Gain

Turns on or off the linear ×10 gain stage in the quasi-peak and average detector signal path. This stage may be enabled/disabled whenever the quasi-peak or EMI average detector is first selected.

Key Access: **Det/Demod, EMI Detector**

Range Dwell

Sets the auto-range dwell time for the EMI Detectors. The amplitude ranging process optimizes the available dynamic range for the measurement. The dwell time is the time spent auto-ranging. You may need to set this value if you have a signal with a very low PRF (< 5Hz). Dwell time must be > 1/PRF.

Key Access: **Det/Demod, EMI Detector**

Demod

Accesses the menu keys to select **AM** demodulation, **FM** demodulation or demodulation **Off**. It also accesses the **Demod View On Off**, **Speaker On Off,** and **Demod Time** menu keys described below.

Key Access: **Det/Demod**

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NOTE The **FM** menu key only appears when the optional FM demodulation hardware is installed (options 106, AYQ or BAA). If you have multiple FM demodulation hardware options, the hardware that will be used is automatically selected in order of priority (with firmware revision A.14.00 or later.)

1. Option 106 - Bluetooth™
2. Option AYQ - Quasi-peak detection and FM demodulation
3. Option BAA - FM Demodulation

NOTE Segmented sweep is not available with the demodulation functions in this section.

Off Turns demodulation off.

Key Access: **Det/Demod**, **Demod**

AM Activating AM demodulation turns off FM demodulation (if it is on). For non-zero spans, a 10 kHz resolution bandwidth is used during demodulation, regardless of the screen annotation. When the span is set to zero span, the displayed bandwidth is used.

Key Access: **Det/Demod**, **Demod**

FM Turning FM demodulation on turns off AM demodulation (if it is on). For non-zero spans, a 100 kHz resolution bandwidth is used during the demodulation, regardless of the screen annotation. When the span is set to zero span, the displayed bandwidth is used. For best results, move the signal to be demodulated to within 3 divisions of the top of the display.

Follow these steps to use this key:

1. Turn auto align off. (**System**, **Alignments**, **Auto Align**, **Off**)
2. Calibrate the demodulator. (**System**, **Alignments**, **Align Now**, **FM Demod)**
3. Set the center frequency. (**FREQUENCY)**
4. Go to zero span. (**SPAN**, **Zero Span)**
5. Set the resolution bandwidth. (**BW/Avg**, **Res BW**)
6. Set the detector to sample. (**Det/Demod**, **Detector**, **Sample**)
7. View the FM demodulation. (**Det/Demod**, **Demod**, **FM, Demod View(On))**
8. Use the Markers to measure the FM demodulation and the modulation rate. (**Marker**)
9. Adjust the sweep time as necessary.

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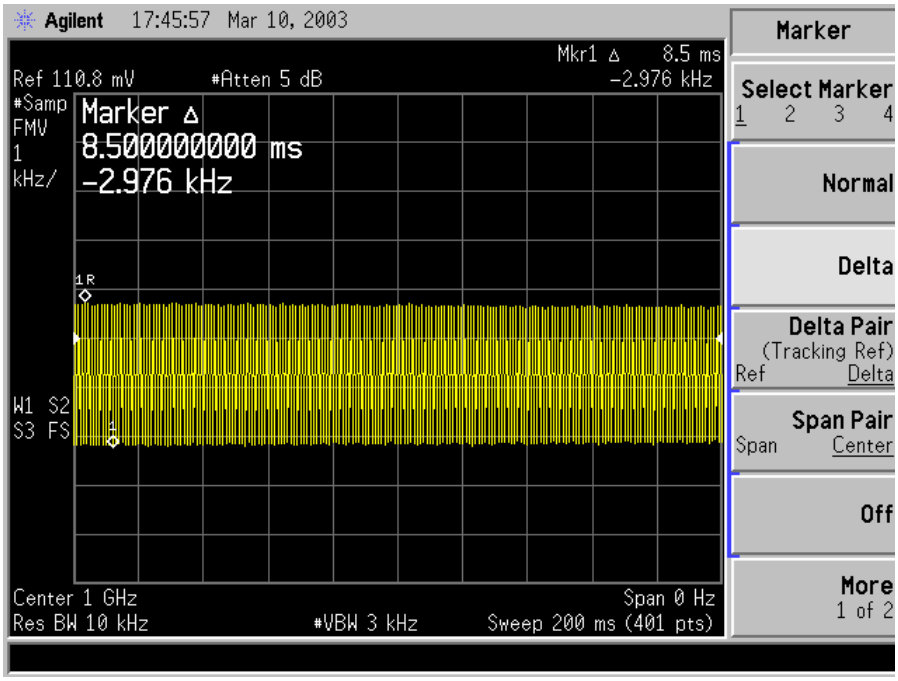
Figure 2-4 1 GHz, -10 dBm, 5 kHz deviation, 5 kHz Modulation Rate



Key Access: **Det/Demod**, **Demod**

Demod View On Off

When **Demod View (On)** is pressed, the vertical scaling of the display is in frequency, and marker will read out the FM deviation in kHz. When Demod View is On, the following functions are not available: Log/Lin (the display is always linear and calibrated in Hz), Y Axis Units, Normalize, Display Line, Peak Excursion, and Peak Threshold. In AM demod, pressing **Demod View (On)** has no effect. FM demod must be selected. The Bluetooth™ FM Demod (Option 106) has a fixed vertical scale of approximately 40 kHz/Div. The exact value is determined by the auto alignment process and is displayed in the upper-left corner of the display.

Key Access: **Det/Demod**, **Demod**

Speaker On Off

Turns the internal speaker on and off. The volume from the speaker is controlled by the front-panel volume control knob. Selecting AM or FM turns the speaker on. Turning AM or FM off, pressing **Preset** when **Preset Type** is set to **Factory**, or cycling the power sets the speaker function to off.

Key Access: **Det/Demod**, **Demod**

Demod Time

Allows you to set the time, in non-zero spans, to pause and demodulate the signal after each sweep. The demodulated signal can be heard during demodulation when in **Speaker (On)** mode.

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In zero span, demodulation is performed (and can be heard) throughout the sweep.

With non-zero spans, in AM the Video BW is set to 3 kHz and the Resolution BW is set to 10 kHz. In FM, the Video BW is set to 30 kHz and the Resolution BW is set to 100 kHz.

When AM or FM demod is enabled, the instrument will tune to the marker frequency and wait for the Demod to take place. **Demod Time** is not available unless AM or FM demod is selected, and span is >0 Hz. For long demodulation times, pressing **Preset** when **Preset Type** is set to **Factory** will abort the Demod function. The default value is 500 ms.

Key Access: **Det/Demod**, **Demod**

NOTE It is normal to hear clicking sounds when the Auto Alignment function is On. During retrace, a small portion of the analyzer circuitry is realigned. Some of the switching of the analyzer circuitry is done using relays. It is the rapid switching of these relays during retrace that causes the clicking sounds. To eliminate the clicking sounds, turn the auto alignment off by pressing **System**, **Alignments**, **Auto Align**, **Off**. When this is done, the **Align Now**, **All** function should be performed periodically. Refer to the Specifications Guide for your instrument to learn more information on how often to perform **Align Now**, **All** when the auto alignment is off.

Squelch

Allows you to adjust the squelch level. The squelch level mutes weak signals and passes strong signals. Only the audio level is affected. If the internal speaker is On, audio signals are not output unless the signal strength exceeds the squelch threshold.

The squelch level does not affect the rear panel AUX VIDEO OUT signal. Squelch level is indicated on screen by the numbers 0 to 100, with 0 being the minimum threshold (all signals are passed) and 100 being the maximum threshold (no signals are passed). The default squelch value is 0. Squelch is active only when FM demod is selected and it is only available when the Option AYQ hardware is used as the instrument's FM demod hardware.

Key Access: **Det/Demod**, **Demod**

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Display

Accesses menu keys that allow you to control what is displayed on the analyzer, including titles, the display line**,** graticule and annotation, as well as the testing of trace data against user entered limits.

Full Screen

Allows the measurement window to expand horizontally over the entire instrument display. Pressing a key that brings up a new menu will cancel the full screen function.

Key Access: **Display**

Display Line
On Off

Activates an adjustable horizontal line that is used as a visual reference line. The line, which can be used for trace arithmetic, has amplitude values that correspond to its vertical position when compared to the reference level. The value of the display line appears in the active function block and on the left side of the display. The display line can be adjusted using the step keys, knob, or numeric keypad. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu. To deactivate the display line, press **Display Line (Off)**.

Key Access: **Display**

Limits

Accesses menu keys that allow you to create and define the parameters of limit lines.

Key Access: **Display**

Limit 1
Limit 2

Allows you to select either of the two available limits. The **Limit 1** and **Limit 2** keys access menu keys that allow you to set parameters for the selected limit.

Key Access: **Display**, **Limits**

Type
Upper Lower

Allows you to define the limit you are editing as either an upper or lower limit. An upper limit fails if trace 1 exceeds the limit. A lower limit fails if trace 1 falls below the limit.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

Limit On Off

Turns the limit line display on and off. Either **Limit** or **Margin**, as well as **Test**, must be turned on for a limit test to work.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

Test
On Off

Turns the testing of the limit lines on and off.

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If trace 1 is at or within the bounds of the set limit or margin, `PASS LIMIT #` or `PASS MARGIN #` is displayed in green in the upper left corner of the measurement area where # is the number of the selected limit line. (Colored annotation appears only with a color display.) Only positive margins are allowed for lower limits and only negative margins are allowed for upper limits. If the trace is out of the limit or margin boundaries, `FAIL LIMIT #` or `FAIL MARGIN #` is displayed in red. The results for Limit 2 are displayed below those for Limit 1. Either **Limit** or **Margin** must be turned on for **Test** to work.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

Margin On Off

Margin (Off) turns the margin off. **Margin (On)** allows you to set a limit line offset for the selected limit line. Either **Limit** or **Margin** as well as **Test**, must be turned on for a limit test to work.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

Edit

Accesses the **Edit** menu keys which include **Point**, **Frequency** (or **Time** if **Display, Limits, X Axis Units (Time)** has been selected), **Amplitude**, **Connected to Previous Pt**, and **Delete Point**. **Edit** also accesses the limits table. The Tab keys allow you to move between the rows in the limits table. New limit segments will only be applied after the editor is closed. Pressing **Return**, or any key not associated with the editor, will close the editor.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

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Point

Allows you to create or edit a limit point. Up to 200 points may be defined for each limit line. Enter the point number to be created or edited using the numeric keypad, then Press **Enter**, or use the knob, Tab or step keys to move to an existing point. After selecting a point, **Frequency** (or **Time**) becomes active.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **Edit**

Frequency (The key label is **Time** if **X Axis Units (Time)** has been selected.)

Allows you to enter the frequency value for a limit point. After entering a value, the limit table is sorted to place the frequency or time in the correct order. For a new point, **Amplitude** defaults to 0 dBm and **Connected to Previous Pt** defaults to **Yes**. **Amplitude** then becomes active.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **Edit**

Amplitude

Allows you to enter the amplitude value for the current limit point. After entering a value, **Connected to Previous Pt** becomes active. If a Tab key is pressed without entering a value, the current **Amplitude** and **Connected to Previous Pt** values of the point are selected. If Tab ⇑ is pressed, the point number automatically increments to allow entry of the amplitude of the next point, or if a new point, to allow **Frequency** to be entered for the new point.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **Edit**

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Connected to Previous Pt
Yes No

Allows you to determine whether the current point will be connected to the previous point. No limit testing is performed between disconnected points. Pressing this key when the Connected field is selected toggles the Connected value of the current point and increments the Point number to allow entry or editing of the Frequency of the next point. If a Tab key is pressed without entering a value, the current Connected value of the point is selected. If Tab ⇑ is pressed, the Point number automatically increments to allow entry of the Connected value of the next point, or if a new point, to allow **Frequency** to be entered for the new point.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **Edit**

Delete Point

Allows you to delete the current point in the limit line. You will be prompted with the message `If you are sure, press key again to delete`. Pressing **Delete Point** again will delete the point.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **Edit**

Delete Limit

Allows you to delete the current limit set. You will be prompted with the message `If you are sure, press key again to delete`. Pressing **Delete** again will delete the limit set.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**

Freq Interp
Log Lin

Allows you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If the linear mode is used for both frequency and amplitude, a straight line is used when interpolating between points in a limit table. If frequency interpolation is logarithmic, frequency values between limit points are computed by first taking the logarithm of both the table values

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and the intermediate value. A linear interpolation is then performed in this logarithmic frequency space. An exactly analogous manipulation is done for logarithmic amplitude interpolation.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **More**

Amptd Interp Log Lin

Allows you to determine how limit trace values are computed between points in a limit table. The available interpolation modes are linear and logarithmic. If the linear mode is used for both frequency and amplitude, a straight line is used when interpolating between points in a limit table.

Key Access: **Display**, **Limits**, **Limit 1** or **Limit 2**, **More**

NOTE Interpolation modes determine how limit values are computed between points in the limit table. The appearance of a limit trace is also affected by the amplitude scale, which may be linear or logarithmic.

X Axis Units Freq Time

Selects whether limit lines will be entered using frequency or sweep time to define the segments. They can be specified as a table of limit line segments of amplitude versus frequency, or of amplitude versus time. Time values are evaluated with respect to the analyzer sweep time. A time value of zero corresponds to the start of the sweep, which is at the left edge of the graticule.

Switching the limit line definition between frequency and time will erase both of the current limit lines. The message `Changing X axis units will delete all limits. If you are sure, press key again to change units` will appear. Press **X Axis Units Freq Time** again to purge both limit lines and switch between frequency and time.

Key Access: **Display**, **Limits**

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Limits Fixed Rel

Allows you to choose fixed or relative limit lines. The fixed (**Fixed**) type uses the current limit line as a reference with fixed frequency and amplitude values. The relative (**Rel**) setting causes the current limit line value to be relative to the displayed center frequency and reference level amplitude values. When limit lines are specified with time, rather than frequency, the **Rel** setting only affects the amplitude values. The current amplitude values will be relative to the displayed reference level amplitude, but the time values will always start at the left edge of the graticule.

As an example, assume you have a frequency limit line. If the limit line is specified as fixed, entering a limit line segment with a frequency coordinate of 300 MHz displays the limit line segment at 300 MHz. If the same limit line table is specified as relative, it is displayed relative to the analyzer center frequency and reference level. If the center frequency is at 1.0 GHz, a relative limit line segment with a frequency coordinate of 300 MHz will display the limit line segment at 1.3 GHz. If the amplitude component of the relative limit line segment is –10 dB, then –10 dB is added to the reference level value to obtain the amplitude of the given segment (reference level offset included).

A limit line entered as fixed may be changed to relative, and one entered as relative may be changed to fixed. When changing between fixed and relative limit lines, the frequency and amplitude values in the limit line table change so that the limit line remains in the same position for the current frequency and amplitude settings of the analyzer. If a time and amplitude limit line is used, the amplitude values change but the time values remain the same.

Key Access: **Display**, **Limits**

Delete All Limits

Allows you to purge data from the limit-line tables. Pressing **Delete Limits** after the prompt, `If you are sure, press key again to delete`, will delete the limits.

Key Access: **Display**, **Limits**

Active Fctn Position

Selects the screen position for the Active Function Display. Depending on the type of trace data being viewed, you can move the Active Function Display position for less visual interference with your screen data.

Key Access: **Display**

Top Displays the active function in the top-left corner of the display.

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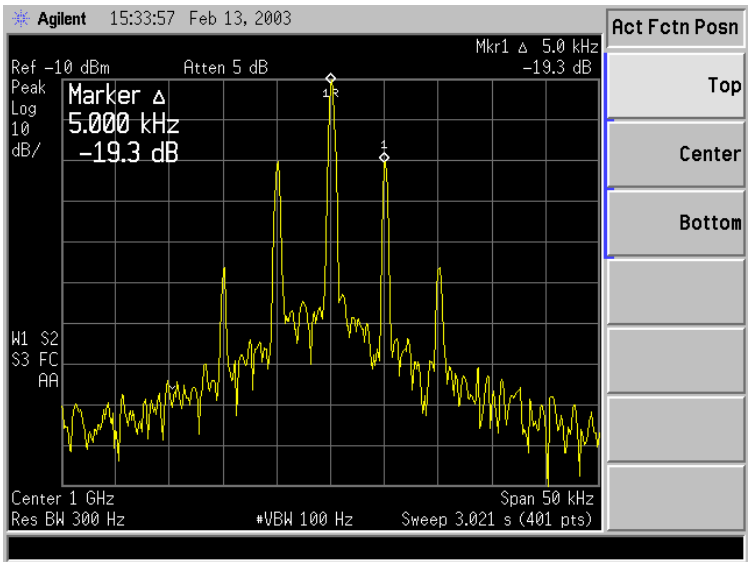
NOTE Do not select **Active Fctn Position**, **Top** when performing limit or margin tests as the pass/fail messages for these functions will be overwritten by the active function information.

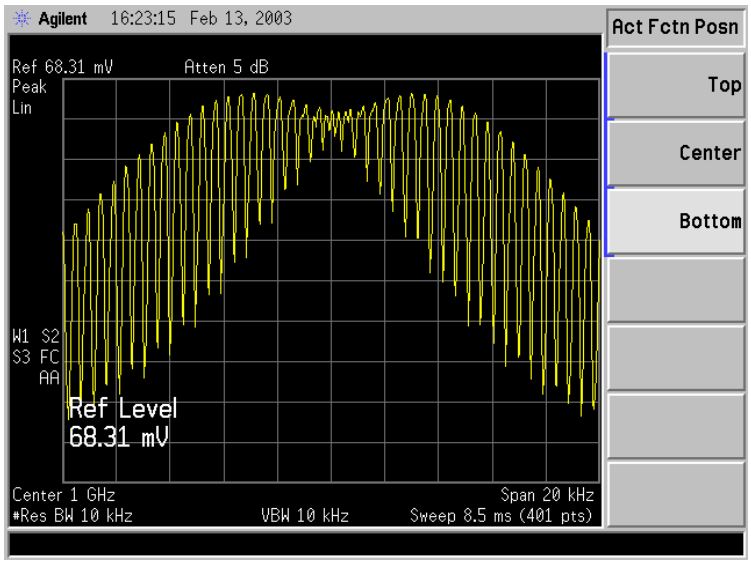


Key Access: **Display**, **Active Fctn Position**

Center Displays the active function in the center-left side of the display.

Key Access: **Display**, **Active Fctn Position**

Bottom Displays the active function in the bottom-left corner of the display



Key Access: **Display**, **Active Fctn Position**

Title Accesses the following **Title** menu keys which allows you to change or clear a title on your display.

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Key Access: **Display**

Change Title Allows you to write a title across the top of the display. The marker readout may interfere with the last characters. The markers can be turned off by pressing **Marker**, **More**, **Marker All Off**. Pressing **Change Title** accesses the Alpha Editor Menus that contain available characters and symbols.

NOTE Pressing **ESC** before exiting the Alpha Editor menus will retain the previous title.

The display title will remain until either **Change Title** is pressed again, or a trace is recalled that was previously saved with a title. A display title can also be cleared by using the clear function. Press **Display**, **Title, Clear Title**.

Key Access: **Display**, **Title**

Clear Title Allows you to clear a title from the front-panel display. Once cleared, the title cannot be retrieved.

Key Access: **Display**, **Title**

Preferences Accesses a menu of the following display functions which allow you to turn the graticule and annotation on or off.

Key Access: **Display**

Graticule
On Off Turns the display graticule on and off.

Key Access: **Display**, **Preferences**

Annotation
On Off Turns the screen annotation on or off, however, menu key annotation will remain on the screen. The screen annotation may not be required for prints or during remote operation.

Key Access: **Display**, **Preferences**

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Enter

Terminates and enters into the analyzer a numerical value that has been entered from the front panel using the numeric keypad. (For most applications, it is better to use the units menu keys.)

When using the **File** key menus, the **Enter** key is used to terminate filename entries. When entering titles (**Display**, **Title**, **Change Title**), the **Enter** key is used to terminate title entries.

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ESC

Use the escape key to exit any function without modifying current parameters. Pressing the **ESC** key will:

- Clear any numeric entry that you have begun to enter and cancels the active function (see the section on display annotation, active function area, and other display features in the Getting Started Guide for your instrument).
- Clear any title entry that you have begun to enter and cause the title to revert to the previous name.
- Clear input or output overloads.
- Clear error messages from the status line along the bottom of the display.
- Clear peak threshold from the display (turn it off) if the peak threshold line is on.
- Cancels a print, if one is in progress.

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File

Accesses the menu keys used to view, save, load, and manage data on a floppy disk or the internal analyzer drive. Refer to the Getting Started Guide for your instrument for more information on file menu functions.

Catalog Displays all directories and files located on the selected drive, depending upon the preferences set under the **Type** and **Sort** keys defined below.

Key Access: **File**

Type Allows you to select all types or one type of file(s) for viewing.

Key Access: **File, Catalog**

All Displays all files located on the selected drive.

Key Access: **File, Catalog, Type**

Setup Displays all setup files (.SET) in the selected directory. Setups are a complete set of instrument parameters including traces, states, limits, and corrections.

Key Access: **File, Catalog, Type**

State Displays all state files (.STA) in the selected directory. State files contain most instrument settings.

Key Access: **File, Catalog, Type**

Trace Displays all trace files (.TRC and .CSV) in the selected directory.

Key Access: **File, Catalog, Type**

Limits Displays all limits files (.LIM) in the selected directory.

Key Access: **File, Catalog, Type**

Screen Displays all screen (.GIF and .WMF) files in the selected directory.

Key Access: **File, Catalog, Type**

Corrections Displays all correction files (.ANT, .CBL, .OTH, .AMP) in the selected directory.

Key Access: **File, Catalog, Type, More**

Measurement Results Displays all measurement results files in the selected directory. Measurement results files are saved in .CSV format (for importing

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into spreadsheets).

Key Access: **File**, **Catalog**, **Type**, **More**

Sort Accesses the **Sort** menu keys that allow you to sort your files according to a selected file attribute.The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order (Up)** allows you to sort files in ascending order (for instance, A,B,C). **Order (Down)** allows you to sort files in descending order (for instance, C,B,A).

Key Access: **File, Catalog**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Catalog**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Catalog**

Save Accesses menu keys that allow you to save analyzer setups, states, traces, limits, corrections and screen data to a floppy (A:) drive or internal flash (C:) drive.

NOTE If you intend to save trace files for use with a personal computer, save them as .CSV (comma separated values). However, files fomatted in this way cannot be loaded back into the analyzer.

NOTE Never remove the floppy disk during a save operation. To do so could corrupt *all* data on the floppy disk.

Key Access: **File**

Save Now Executes the save function. When the save is complete, the message `XXXXXX file saved` (where XXXXXX is the filename) will appear in the status line on your display.

Note that once you have used the **File**, **Save**, **Save Now** keys to setup and save a file, the **Save** hardkey will perform an immediate **Save Now** of your file in the same format and to the same location.

Key Access: **File, Save**

NOTE If the **`Path:`** field above the directory box is empty when pressing **Save Now**, the status line will display the error message: `Unable to save file, invalid path`. In this case, please select a drive.

Type Allows you to select the type of data you want to save.

Setup Displays all previously saved setup files and

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detects the current setup parameters in preparation to save them in a file for retrieval at a future date. Setup files include all instrument settings including traces, states, limits, and corrections.

NOTE When viewing a floppy disc with saved Setup files (filename.set) on a personal computer, notice there are also many similarly named files with extensions like .s01, .s02, etc. Do not delete these files as they are necessary to allow complete restoration of originally saved Setup.

Key Access: **File, Save, Type**

State Displays all previously saved state files and detects the current state parameters in preparation to save them in a file for retrieval at a future date. State files include all instrument settings but not traces, limits, and corrections. (This is the default setting when power is applied to the analyzer.)

Key Access: **File, Save, Type**

Trace Displays all previously saved trace files (.TRC) and detects the current trace in preparation to save it in a file for retrieval at a future date. A trace can be saved individually or as a group of traces. It can also be saved in .CSV (comma separated values) format (for importing into spreadsheets) or in .TRC format, accompanied by the analyzer state (for later recalling into the analyzer). (Note that CSV formatted data cannot be reloaded into the analyzer and TRC formatted data cannot be loaded into most personal computer programs.) Refer to the **Format** key description.

Key Access: **File, Save, Type**

Limits Displays all previously saved limits files and detects the current limits in preparation to save them in a file for retrieval at a future date. Limits provide data sets to determine whether a trace has exceeded preset specifications. Limit sets can hold up to 200 points and can only be saved individually. Refer to the **File, Source** key description.

Key Access: **File, Save, Type**

Screen Displays all previously saved screen files and

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captures the current screen displayed in preparation to save it in a file for retrieval at a future date. Screen files can be saved in any of the following formats: Bitmap, Metafile, Reverse Bitmap, and Reverse Metafile. Refer to the **Format** key description.

Key Access: **File, Save, Type**

NOTE Screen files saved in WMF format can *only* be loaded into Microsoft®[1] applications such as Microsoft Word.

NOTE The screen saved is that which was displayed before pressing **File**. For this reason, the screens seen while in the file menus cannot be saved.

Corrections Displays all previously saved correction files and detects the current corrections in preparation to save them in a file for retrieval at a future date. Corrections provide a way to adjust the trace display for preset gain factors (such as for cable loss). A correction set may hold up to 200 points. Pressing **Corrections** activates the **Source** key. Refer to the **Source** key description.

Key Access: **File, Save, Type, More**

Measurement Results Displays all previously saved measurement results files and detects the current measurement results in preparation to save them in a file for retrieval at a future date. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Save, Type, More**

Format *When **Type** is set to **Trace**,* **Format** allows you to save a trace accompanied by the analyzer state. The **CSV** format is readable by a spreadsheet on your PC, but cannot be loaded back into the analyzer. The TRC format cannot be loaded into a PC, but can be loaded back into the analyzer. TRC files include the state of the analyzer and restore all settings when loaded.

*When **Type** is set to **Screen**,* **Format** allows you to choose between bitmap and metafile formats. **Bitmap** saves the screen image in Graphics Interchange Format (GIF) and **Metafile** saves the screen image in Windows Metafile Format (WMF). **Reverse Bitmap** and **Reverse Metafile** turn black backgrounds to white

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and yellow traces to green so they can be printed visibly and with less use of black ink. Screen images cannot be loaded back into the analyzer.

Key Access: **File, Save**

Source

*When **Type** is set to **Trace***, **Source** allows you to save trace **1**, **2**, or **3** along with state. Saving trace **All** saves all traces in a single .trc file, along with the state.

*When **Type** is set to **Corrections***, **Source** accesses the **Antenna**, **Cable**, **Other** and **User** menu keys, which allow you to select the type of correction to be saved.

*When **Type** is set to **Limits***, **Source** accesses the **Limit 1** and **Limit 2** menu keys. **Limit 1** and **Limit 2** provide data sets to determine whether a trace has exceeded preset specifications. Limit sets can hold up to 200 points and can only be saved individually.

Key Access: **File, Save**

Name

Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed.

Key Access: **File, Save**

NOTE

Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 character extension which is automatically set by the instrument.

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Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Save**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Save**

Load Accesses menu keys that allow you to load analyzer setups, states, traces, limits and corrections into the analyzer from a floppy (A:) drive or internal flash (C:) drive.

Key Access: **File**

Load Now Executes the load function. When the load is complete, the message `XXXXXX file loaded` (where XXXXXX is the filename) will appear in the status line on your display.

Key Access: **File, Load**

Type Allows you to select the type of file you want to load.

Setup Displays all setup files you may wish to load (.SET). Setup files include a complete set of instrument parameters including traces, states, limits, and corrections. Loading a setup restores the analyzer (as closely as possible) to all previous instrument settings at the time of the save.

Key Access: **File, Load, Type**

State Displays all state files you may wish to load (.STA). Loading a state restores most settings to the previously saved values.

Key Access: **File, Load, Type**

Trace Displays all trace files (.TRC) you may wish to load. Traces can be loaded individually or as a group. When a trace is loaded, the state that existed when that trace was saved is loaded along with the trace. Also, the loaded trace is placed in view mode.

Key Access: **File, Load, Type**

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NOTE If you wish to compare two saved traces, place traces in view mode before saving them. This prevents the trace from being rewritten based on a state change from subsequent loads.

Limits Displays all limits files you may wish to load to determine whether a trace has exceeded preset specifications (.LIM). Limit sets can hold up to 200 points. Limits can only be loaded individually.

Key Access: **File, Load, Type**

NOTE When loading Limits files, be sure you have selected the appropriate X Axis Units: frequency or time (**Display**, **Limits**, **X Axis Units**). If you are in time X-Axis Units, and you load frequency limits, all current limit line data will be erased and the analyzer will switch to frequency units. The reverse of the this situation also holds true.

Corrections Displays all corrections files you may wish to load (.CBL, .ANT, .OTH, .AMP). Corrections provide a way to adjust the trace display for preset gain factors (such as for cable loss). A correction set may hold up to 200 points.

Key Access: **File, Load, Type, More**

Measurement Results Displays all previously saved measurement results files you may wish to load. Measurement results files are saved in .CSV format (for importing into spreadsheets).

Key Access: **File, Load, Type, More**

Sort Accesses the **Sort** menu key.

Sort accesses a menu of keys that allow you to view your saved files according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order** (Up) allows you to view files in ascending order (for instance, A,B,C). **Order** (Down) allows you to view files in descending order (for instance, C,B,A).

Key Access: **File, Load**

Destination *When **Type** is set to **Trace***, **Destination** allows you to direct your data to **Trace 1**, **Trace 2**, or **Trace 3**. If the data is for all three traces (for instance, **Source** was **All** when they were saved), the data will be returned to the original trace registers.

*When **Type** is set to **Limits***, **Destination** allows you to direct your

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data to **Limit 1** or **Limit 2**.

Key Access: **File, Load**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Load**

Dir Select Accesses the highlighted directory on your display. If [. .] is highlighted, this key acts in the same manner as **Dir Up**.

Key Access: **File, Load**

Delete Allows you to delete files and directories.

Key Access: **File**

Delete Now Executes the delete function. If a directory is selected to be deleted, the message `WARNING: You are about to delete the contents of directory XXXXXX` (where XXXXXX is the full path and directory name) will appear on your display. After a successful delete, the message `XXXXXX file deleted` (where XXXXXX is the filename) will appear in the status line on your display.

Key Access: **File, Delete**

Type Allows you to select the type of file you want to delete.

Key Access: **File, Delete**

All Displays all files you may wish to delete.

Key Access: **File, Delete**, **Type**

Setup Displays all setup files you may wish to delete (.SET). A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

Key Access: **File, Delete**, **Type**

State Displays all state files you may wish to delete (.STA).

Key Access: **File, Delete**, **Type**

Trace Displays all trace files you may wish to delete (.TRC and .CSV).

Key Access: **File, Delete**, **Type**

Limits Displays all limits files you may wish to delete (.LIM).

Key Access: **File, Delete**, **Type**

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Screen Displays all screen files you may wish to delete (.GIF and .WMF).

Key Access: **File, Delete**, **Type**

Corrections Displays all corrections files you may wish to delete (.CBL, .ANT, .OTH, .AMP).

Key Access: **File, Delete**, **Type**, **More**

Measurement Results Displays all previously saved measurement results files you may wish to delete. Measurement results files are saved in (.CSV) format (for importing into spreadsheets).

Key Access: **File, Delete, Type, More**

Sort **Sort** accesses a menu of keys that allow you view the files you wish to delete, according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order (Up)** allows you to view files you may wish to delete in ascending order (for instance, A,B,C). **Order (Down)** allows you to view files you may wish to delete in descending order (for instance, C,B,A).

Key Access: **File, Delete**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Delete**

Dir Select Accesses the highlighted directory on your display. If [. .] is highlighted, this key acts in the same manner as **Dir Up**.

Key Access: **File, Delete**

Copy Allows you to copy files from one directory to another or to one or more mass storage devices.

Key Access: **File**

Copy Now. Executes the copy function. If the copy is successful, the message `xxxxx file copied` (where xxxxx is the filename) will appear on the display.

Key Access: **File**, **Copy**

Type. Allows you to select the type of file you want to copy.

Key Access: **File**, **Copy**

All. Displays all files you may wish to copy.

Key Access: **File**, **Copy**, **Type**

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Setup. Displays all setup (.SET) files you may wish to copy. A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

NOTE When using a personal computer to copy Setup files, ensure the similarly named files with extensions like .s01, .so2, etc. are also copied. These files are necessary to allow complete restoration of originally saved Setup.

Key Access: **File**, **Copy**, **Type**

State. Displays all state (.STA) files you may wish to copy.

Key Access: **File**, **Copy**, **Type**

Trace. Displays all trace (.TRC and .CSV) files you may wish to copy.

Key Access: **File**, **Copy**, **Type**

Limits. Displays all limit (.LIM) files you may wish to rename.

Key Access: **File**, **Copy**, **Type**

Screen. Displays all screen (.GIF and .WMF) files you may wish to rename.

Key Access: **File**, **Copy**, **Type**

Corrections. Displays all corrections (.CBL, .ANT, .OTH, .AMP) files you may wish to rename.

Key Access: **File**, **Copy**, **Type**, **More**

Measurement Results. Displays all previously saved measurement results files you may wish to delete. Measurement results files are saved in (.CSV) format (for importing into spreadsheets).

Key Access: **File, Copy, Type, More**

Sort. **Sort** accesses a menu of keys that allow you to view the files you wish to copy according to a selected file attribute. The selection includes, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order (Up)** allows you to view files you may wish to copy in ascending order (for instance, A,B,C). **Order (Down)** allows you to view files you may wish to copy in descending order (for instance, C,B,A).

Key Access: **File, Copy**

Dir
From To. Allows you to select the source and destination directories for

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your copy on one or more drives.

Key Access: **File, Copy**

Dir Up. Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Copy**

Dir Select. Accesses the highlighted directory on your display.

Key Access: **File, Copy**

Rename Allows you to rename a file.

Key Access: **File**

Rename Now Executes the rename function. When the rename is complete, the message `XXXXXX file renamed to YYYYYY` (where XXXXXX and YYYYYY are the filenames) will appear in the status line on your display.

Key Access: **File, Rename**

Type Allows you to select the type of file you want to rename.

Key Access: **File, Rename**

All Displays all files you may wish to rename.

Key Access: **File, Rename**, **Type**

Setup Displays all setup (.SET) files you may wish to rename. A Setup file is a complete state of instrument parameters including traces, states, limits and corrections.

Key Access: **File, Rename**, **Type**

State Displays all state (.STA) files you may wish to rename.

Key Access: **File, Rename**, **Type**

Trace Displays all trace (.TRC and .CSV) files you may wish to rename.

Key Access: **File, Rename**, **Type**

Limits Displays all limit (.LIM) files you may wish to rename.

Key Access: **File, Rename**, **Type**

Screen Displays all screen (.GIF and .WMF) files you may wish to rename.

Key Access: **File, Rename**, **Type**

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Corrections Displays all corrections (.CBL, .ANT, .OTH, .AMP) files you may wish to rename.

Key Access: **File, Rename**, **Type**, **More**

Measurement Results Displays all previously saved measurement results files you may wish to rename. Measurement results files are saved in (.CSV) format (for importing into spreadsheets).

Key Access: **File, Rename, Type, More**

Sort **Sort** accesses a menu of keys that allow you to view the files you wish to rename according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order Up Down**. **Order (UP)** allows you to view files you may wish to rename in ascending order (for instance, A,B,C). **Order (Down)** allows you to view files you may wish to rename in descending order (for instance, C,B,A).

Key Access: **File, Rename**

Name Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed. Complete your entry by pressing **Return** or **Enter**.

NOTE Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 character extension which is automatically set by the instrument.

Key Access: **File, Rename**

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, Rename**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, Rename**

Create Dir Allows you to create subdirectories.

Key Access: **File, More**

Create Dir Now Executes the create directory function. When the directory has been created, the message `Directory XXXXXX created` (where XXXXXX is the directory name) will appear in the status line on your display.

Key Access: **File, More, Create Dir**

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Name Accesses the Alpha Editor and allows you to enter a filename. The external keyboard can also be used to enter a filename while the alpha editor is accessed. Complete your entry by pressing **Return** or **Enter**.

Key Access: **File, More, Create Dir**

NOTE Only capital letters (A-Z) and digits (0-9) may appear in file names (8 characters, maximum). Additionally, file names include a 3 digit extension which is automatically set by the instrument.

Dir Up Allows you to move up one directory level. If at the top level, **Dir Up** moves to the drive level, displaying the available disk drives.

Key Access: **File, More, Create Dir**

Dir Select Accesses the highlighted directory on your display.

Key Access: **File, More, Create Dir**

Format Formats a double-density floppy disk to 1.44 MB format. 720 kB disks are not supported.

Key Access: **File**, **More**

Format Now Executes the format function. After pressing **Format Now**, the following message will appear on the display: `WARNING: You are about to destroy ALL data on volume A: Press Format Now again to proceed or any other key to abort.` During the formatting, Formatting Disk will appear on the display. Once formatted, Volume A: formatted will appear in the status line on the display.

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NOTE When using a personal computer to manipulate Setup files (filename.set) saved to a floppy, ensure the similarly named files with extensions like .s01, .s02, etc. are handled in a like manner. For example, if you rename of the .set file, you must rename all the .s0x files, as well. These files are necessary to allow complete restoration of the originally saved Setup.

Key Access: **File, More, Format**

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Freq Count

Activates the **Marker Normal** function if there are no markers, and then turns the marker count function on.

Marker Count On Off

Marker Count (On) turns on the marker counter. If no marker is active before **Marker Count (On)** is pressed, a marker is activated at the center of the display. Press **Marker Count (Off)** to turn the marker counter off. Press **Resolution (Man)** to change the marker counter resolution to an uncoupled value.

NOTE

Marker Count frequency readings are not affected by the frequency offset function.

An asterisk (**`*`**) may appear in the upper-right area of the display along with the message **`Cntr 1`** (the number in the message depends on the active marker). The ratio of the resolution bandwidth to span must be greater than 0.002 for the marker count function to work properly. `Marker Count: Widen Res BW` appears on the display if the bandwidth to span ratio is less than 0.002. `Widen RES BW` indicates that the resolution bandwidth must be increased or the span decreased.

Key Access: **Freq Count**

Resolution Auto Man

Allows the resolution of the marker counter to be selected manually or auto-coupled. The marker counter has a resolution range of 1 Hz to 100 kHz. The available resolution values are 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz. The resolution can be changed by using the step keys or by entering the resolution using the numeric keypad or knob. The marker counter resolution can be auto coupled to the span by pressing **Resolution (Auto)**.

Key Access: **Freq Count**

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FREQUENCY Channel

Activates the center frequency function, and accesses the menu of frequency functions. The center frequency, or start and stop frequency values appear below the graticule on the display.

Although the analyzer allows entry of frequencies greater than the specified frequency range, using frequencies greater than the frequency range of the analyzer is not recommended

NOTE When changing both the center frequency and the span, change the frequency first since the span can be limited by the frequency value.

CAUTION When operating in dc coupled mode, take care to protect the input mixer by limiting the input level to 0 Vdc and +30 dBm.

Center Freq Activates the center frequency function (when **Scale Type** is set to **Lin**) which allows you to set the horizontal center of the display to a specific frequency. When **Scale Type** is set to **Log**, **Center Freq** activates the center frequency function which allows you to move the average of the start and stop frequencies. In this scale type the center frequency value will not necessarily represent the horizontal center of the display.

Key Access: **FREQUENCY Channel**

Start Freq Sets the frequency at the left side of the graticule. The left and right sides of the graticule correspond to the start and stop frequencies. When these frequencies are activated, their values are displayed below the graticule in place of center frequency and span.

Key Access: **FREQUENCY Channel**

Stop Freq Sets the frequency at the right side of the graticule. The left and right sides of the graticule correspond to the start and stop frequencies. When these frequencies are activated, their values are displayed below the graticule in place of center frequency and span.

Key Access: **FREQUENCY Channel**

CF Step Auto Man Changes the step size for the center frequency function. Once a step size has been selected and the center frequency function is activated, the step keys change center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer. When auto-coupled, the center frequency step size is set to one division (10 percent of the span).

Key Access: **FREQUENCY Channel**

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Freq Offset

Allows you to input a frequency offset value that is added to the frequency readout of the marker, to account for frequency conversions external to the analyzer. Offset entries are added to all frequency readouts including marker, start frequency, and stop frequency. Offsets may only be entered using the numeric keypad. Offsets are not added to the span or frequency count readouts. Entering an offset does not affect the trace display. When a frequency offset is entered, its value appears on the bottom of the display. To eliminate an offset, perform a **Factory Preset**, or press **Freq Offset**, **0**, **Hz**.

When a frequency offset is entered, its value appears on the bottom of the display (as opposed to reference level offsets, which appear on the left side of the display). To eliminate an offset, press **Freq Offset**, **0**, and **Enter**. Pressing **Preset** also sets the offset to zero.

NOTE This function is not available when **FREQUENCY, Scale Type (Log)** is selected.

NOTE **Frequency, Scale Type (Log)** is not available when utilizing the frequency offset function.

Key Access: **FREQUENCY Channel**

Signal Track On Off

Moves the signal that is nearest to the active marker to the center of the display and keeps the signal there. `ST` appears in the lower-left corner of the display. An (`*`) may appear in the upper-right corner of the display while the analyzer is verifying that it has the correct signal.

Pressing **Signal Track (Off)**; **Preset** (with **Preset Type** set to **Factory**); or **Marker**, **More**, **Marker All Off** turns off the signal track function.

When signal track is on and the span is reduced, an automatic zoom is performed and the span is reduced in steps so that the signal remains at the center of the display. If the span is zero, signal track cannot be activated.

Key Access: **FREQUENCY Channel**

NOTE If no marker is active, pressing **Signal Track (On)** will activate a marker, perform a peak search, and center the marker on the display.

NOTE Switching to zero span sets **Signal Track (Off)**.

NOTE **FREQUENCY, Scale Type (Log)** and **Segmented (On)** are not available when **Signal Track (On)** is selected.

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Scale Type Log Lin

Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B). Scales the horizontal (x-axis or frequency) graticule divisions logarithmically when **Scale Type (Log)** is selected. When **Scale Type (Lin)** is selected, the horizontal divisions are linearly scaled.

In **Scale Type (Log)**, the number of sweep points is limited to a multiple of the number of sweep segments. For example, if you select 308 points when 3 segments are required to create a logarithmic display, the points will be set at 306 points. The span determines the minimum number of sweep points. Pressing **Preset** (when **Preset Type** is set to **Factory**) sets **Scale Type to Lin**.

NOTE Sweep time is auto-coupled when **Scale Type (Log)** is selected.

NOTE **Marker Span Pair, Frequency Offset, Input Mixer (Ext), Segmented (On)**, **Signal Track (On)**, and **Demod View (On)**, are not available when **Scale Type (Log)** is selected.

NOTE **FREQUENCY, Scale Type (Log)** is not available when **Frequency Offset**, **Segmented (On)**, **Input Mixer (Ext)**, **Zero Span, Signal Track (On)** is selected.

Key Access: **FREQUENCY Channel**

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Help

Accesses a short description of any front panel or menu key. After pressing **Help**, an explanation of the next key pressed will appear on the display. After the information is displayed, press any key to remove the help window. Pressing **ESC** allows you to remove the help window without changing functions.

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Input/Output

Input Z Corr
50Ω 75Ω

Sets the input impedance for voltage-to-power conversions. The impedance you select is for computational purposes only, since the actual impedance is set by internal hardware to 50 Ω (except for Option 1DP). The default is 50 Ω (75 Ω with Option 1DP). Setting the computational input impedance to 75 Ω is useful when using a 75 Ω to 50 Ω adapter to measure a 75 Ω device on an analyzer having a 50 Ω input impedance.

Key Access: **Input/Output**

Coupling
AC DC

Only available in Agilent models E4402B or E4407B with Option UKB, and E4404B or E4405B. Specifies alternating current (ac) or direct current (dc) coupling at the analyzer input. Selecting ac coupling blocks any dc voltage at the analyzer input, but also decreases the frequency range of the analyzer. Input coupling is set to ac by an instrument preset (With **Preset Type** set to **Factory**). Some amplitude specifications apply only when coupling is set to dc. Refer to the appropriate amplitude specifications and characteristics for your analyzer.

Table 2-1 **Selecting Input Coupling**

ESA Model #	AC Frequency Range	DC Frequency Range
E4402B with Option UKB	100 kHz to 3 GHz	100 Hz to 3 GHz
E4404B	100 kHz to 6.7 GHz	9 kHz to 6.7 GHz
E4404B with Option UKB	100 kHz to 6.7 GHz	100 Hz to 6.7 GHz
E4405B	100 kHz to 13.2 GHz	9 kHz to 13.2 GHz
E4405B with Option UKB	100 kHz to 13.2 GHz	100 Hz to 13.2 GHz
E4407B with Option UKB	10 MHz to 26.5 GHz	100 Hz to 26.5 GHz

CAUTION

When operating in dc coupled mode, ensure protection of the input mixer by limiting the input level to 0 Vdc, +30 dBm.

Key Access: **Input/Output**

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Amptd Ref (f=50 MHz) On Off

Agilent E4401B and E4411B only. Turns the internal amplitude reference signal on or off. When the internal amplitude reference signal is on, the RF input is disabled.

Key Access: **Input/Output**

Amptd Ref Out (f=50 MHz) On Off

Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B only. Turns the external amplitude reference signal on or off.

Key Access: **Input/Output**

Input Mixer

Agilent E4407B with Option AYZ only. Accesses the following Input Mixer menu keys:

Key Access: **Input/Output**

Input Mixer

Int Ext Allows you to select either the internal or an externally connected mixer as the input device. Selecting **Input Mixer (Ext)** activates all other keys in the Input Mixer menu and changes the attenuator annotation to `Ext Mix`. When **Input Mixer (Ext)** is selected, the attenuator function in the **AMPLITUDE** key menu is unavailable.

Key Access: **Input/Output**, **Input Mixer**

NOTE When **Input Mixer (Ext)** is selected, **FREQUENCY, Scale Type (Log)** is not available.

NOTE **Input Mixer (Ext)** is not available when **FREQUENCY, Scale Type (Log)** is selected.

Ext Mix Band Accesses the Ext Mix Band key menus and allows you to select one of the pre-defined bands corresponding to the external mixer being used. The start and stop frequencies and a letter corresponding to the waveguide band in use, appears on each menu key. If **Mixer Type (Presel)** is selected, selecting **(K)**, **(E)**, **(W)**, **(F)**, **(D)**, **(G)**, **(Y)**, or **(J)** is not allowed. If **Harmonic (Man)** is selected, the word **User** will appear on the **Ext Mix Band** key.

Key Access: **Input/Output**, **Input Mixer**

NOTE Segmented sweep is only operable for this function when center frequency and span are set within the frequency band of the mixer. If the mixer range is changed, segmented sweep is turned off.

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Signal Ident
On Off

Activates a signal identification algorithm when **Signal Ident (On)** is selected, that either removes or aids with the identification of multiple and image responses of true input signals. Multiple and image responses maybe generated when using unpreselected external mixers.

Key Access: **Input/Output**, **Input Mixer**

NOTE Segmented sweep is not available when **Signal Ident (On)** is selected.

NOTE If the input signal is too broad band or unstable for the identification process to properly identify it, turn off the signal identification and look for two similar responses separated by approximately 642.8 MHz (twice the 321.4 MHz first IF). If a "–" mixer mode (for example: 8–) is active, the right member of the response pair is the correct response; if a "+" mixer mode is active, the left member of the response pair is the correct response.

The amplitude accuracy of the analyzer is degraded when signal identification is active, and the message `Signal Ident On, Amptd Uncal` will appear on the display.

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Signal ID Mode

Allows you to select either of the following types of signal identification methods:

Key Access: **Input/Output**, **Input Mixer**

Image Suppress

Selects a signal identification mode that attempts to suppress all but valid responses by mathematically removing all image and multiple responses of signals present at the mixer input. The analyzer internally acquires the data in a two sweep sequence, operates on the acquired data, and displays the result in Trace 1. Since two measurements are taken for each display cycle, the display update rate is reduced.

Key Access: **Input/Output**, **Input Mixer**, **Signal ID Mode**

Image Shift

Allows the analyzer, in a two sweep sequence, to place data from the first sweep in Trace 1, and data from the second (frequency shifted) sweep in Trace 2. Signal responses of Trace 1 and Trace 2 having the same horizontal position are considered to be in the current band and therefore can be analyzed with the amplitude and frequency measurement systems of the analyzer. All other responses are invalid and should be ignored.

Key Access: **Input/Output**, **Input Mixer**, **Signal ID Mode**

Mixer Config

Accesses the Mixer Config menu keys allowing you to manually set the harmonic, control the preselected mixers, and adjust the internal bias source for use with mixers requiring bias.

Key Access: **Input/Output**, **Input Mixer**

Harmonic Auto Man

The harmonic value with its associated sign is automatically determined from the Ext Mix Band selected when in **Harmonic (Auto)** mode. **Harmonic (Man)** allows you to enter a harmonic value when required. If the harmonic mode for the external mixer is listed as “8 –”, for example, enter the harmonic number as “– 8”. The minus sign indicates that the tuned frequency is below the desired LO harmonic by the IF of 321.4 MHz. Similarly, if the harmonic mode of the

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external mixer is listed as “8 +”, enter the harmonic number as “8”.

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

Mixer Type
Presel Unpre

Allows you to select which type of mixer is in use. **Mixer Type (Presel)** activates a tuning signal that is routed to the **PRESEL TUNE OUTPUT** connector on the rear panel of the analyzer. This signal has a sensitivity of 1.5V/GHz of the LO frequency and drives the tune input of the HP/Agilent 11974 series of preselected mixers. The sweep rate in **Presel** mode is limited to 40 MHz/msec.

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

Mixer Bias
On Off

Mixer Bias (On) activates and allows adjustment of an internal bias source for use with external mixers. The bias signal is present on the center conductor of the IF INPUT connector on the front panel. The mixer bias will be **Off** if **Harmonic (Auto)** and **Mixer Type (Presel)** is selected.

Key Access: **Input/Output**, **Input Mixer**, **Mixer Config**

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Marker

Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points of traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the "active" marker. Pressing **Marker** activates the **Normal** menu key.

Select Marker 1 2 3 4

Selects one of the four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Key Access: **Marker**

Normal

Activates a single frequency marker at the center position of the active trace if a marker is not already displayed. If a marker is displayed before the **Normal** function is enabled, the marker is enabled at the position of the selected marker. The marker number is indicated above the marker. Use the data controls to position the marker. The knob and/or Up/Down keys move the marker left or right. If a value is entered from the numeric keypad, the marker is moved to the trace point nearest to that value. Annotation in the active function block and in the upper-right corner of the display indicates the frequency and amplitude of the marker (time and amplitude, if in zero span.) The marker stays on the trace at the horizontal screen position where it was placed unless **Signal Track**, or a "marker to" key function (such as **Mkr → CF**, **Mkr → RL**, **Mkr → CF STEP**, **Mkr Δ Span**, or **Min Search**) is selected.Pressing **Normal** turns off the **Delta** function and moves the active marker to the delta marker position.

Key Access: **Marker**

Delta

Activates a second marker at the position of the first marker. (If no marker is present, two markers appear at the center of the display.) The amplitude and frequency (or time) of the first marker is fixed. The marker number is indicated above the delta marker, and the same number is indicated with an `R` (for example, `1R`) above the reference marker. Use the data controls to position the delta marker. Annotation in the active function block and in the upper-right corner of the display indicates the frequency (or time) and amplitude differences between the two markers. The markers will be turned off if the scale type is changed between log and linear. (For information on using this function while in segmented sweep, refer to "Interaction with Other Analyzer Functions" in the segmented sweep section of this chapter which begins on "Segmented" on page 145.)

Key Access: **Marker**

NOTE

Pressing **Delta** again moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

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NOTE The delta marker function permits signal-to-noise measurements provided the signal is a single spectral component (sinusoid). Place a normal marker on the signal, press **Delta**, place the delta marker in the noise, and activate **Marker Noise** (see below). The indicated amplitude difference is signal-to-noise/Hz.

Delta Pair
Ref Delta

Enters a mode that allows adjustment of both the **Ref** (start) and **Delta** (stop) markers independently. Pressing **Delta Pair**, toggles between the reference and delta markers. The start marker number is indicated with a number and an `R` above the marker (for example, `1R`) and the delta marker is indicated with a marker number. This mode is useful in functions such as **Band Power**. (For information on using this function while in segmented sweep, refer to "Interaction with Other Analyzer Functions" in the segmented sweep section of this chapter which begins on "Segmented" on page 145.)

Key Access: **Marker**

NOTE Ref and Delta markers maintain their displayed x-axis location, but not their frequency values when you change a parameter that redefines the x-axis scale. Reset these markers when parameters such as Span or Center Freq are changed.

Span Pair
Span Center

Enters a mode that allows adjustment of both the ref and delta markers. Pressing **Span Pair**, toggles between the span and center markers. The start marker number is indicated with a number and an `R` above the marker (for example, `1R`) and the stop marker is indicated with a marker number. Adjusting the span changes the frequency difference between the two markers while maintaining the midpoint between the two markers at a fixed frequency. Changing the center changes the center point between the two markers while maintaining the frequency difference. This mode is useful in functions such as **Band Power**. (For information on using this function while in segmented sweep, refer to "Interaction with Other Analyzer Functions" in the segmented sweep section of this chapter which begins on "Segmented" on page 145.)

NOTE Span Pair is not available when **FREQUENCY**, **Scale Type (Log)** is selected.

Key Access: **Marker**

Off

Turns off the marker that has been selected by the **Select Marker 1 2 3 4** key. **Off** also turns off functions related to the selected marker such as signal track and demodulation. It also removes marker annotation from the display.

Key Access: **Marker**

Select Marker
1 2 3 4

Selects one of the four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has already been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

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Key Access: **Marker**, **More**

Marker Trace Auto 1 2 3

Assigns a marker to a trace. Pressing **Marker Trace Auto 1 2 3** will activate a marker on trace 1 if there are no markers turned on. If a marker is currently active, press **Marker Trace Auto 1 2 3** until **1**, **2**, or **3** is underlined. The active marker will be moved to the selected trace.

Selecting the **Auto** mode will move the marker to the trace that is automatically selected. The selection order is to look for the lowest numbered trace in the following order of trace modes: clear-write, max- hold, min-hold, view-mode. If there are no traces in any of these modes, it selects trace 1.

Key Access: **Marker**, **More**

Readout

Accesses the following menu keys that allow you to change the active marker readout.

Key Access: **Marker**, **More**

Frequency

Sets the marker to **Frequency**. The default selection in non-zero spans, displays the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker.

Key Access: **Marker**, **More**, **Readout**

Period

Sets the marker readout to **Period**. Displays the reciprocal of the above frequency.

Key Access: **Marker**, **More**, **Readout**

Time

Sets the marker readout to **Time**. The default selection in zero span, displays the time interval between a normal marker and the start of the sweep or the time of the delta marker relative to the reference marker.

Key Access: **Marker, More, Readout**

Inverse Time

Sets the marker readout to **Inverse Time**. Displays the reciprocal of the above time interval.

Key Access: **Marker**, **More**, **Readout**

Function

Accesses the following marker function menu keys listed below.

Key Access: **Marker**, **More**

Band Power

Indicates the power over that part of the trace between the reference and active markers. If only one marker is present when you press **Band Power**, a second marker is placed at the same location as the first marker. To reposition the markers, press **Marker** to access **Delta Pair** and **Span Pair** keys. If **Detector (Auto)** is selected, average detection is used for RBW ≥ 1 kHz, and Sample detection is used for RBW < 1 KHz.

The repeatability of your band power marker measurement can be impacted by the current number of sweep points being used.

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If you only have a few sweep points in the measurement band of interest, then small changes will have a direct impact on the measurement result. Increasing your number of sweep points will decrease that affect and improve the repeatability.

Key Access: **Marker**, **More**, **Function**

NOTE For best accuracy, set the video bandwidth to at least ten times the resolution bandwidth to minimize its averaging effect.

NOTE **Band Power** has no meaning in zero span, and the indicated value is independent of signal level and marker placement.

Marker Noise Reads out the average noise level, referenced to a 1 Hz noise power bandwidth. If no marker is present, a marker appears at the center of the display. When Marker Noise is enabled in resolution bandwidths of 1 kHz and above, the auto coupled detector selection is set to Average and the Avg Type is set to Power because the trade-off between sweep time and variance of the result is best with power Average detection. (When the **Average** detector is selected and the amplitude scale is linear, the fastest sweet time is 8 milliseconds.) In resolution bandwidths < 1 kHz, the auto coupled detector selection is Sample. However, the Marker Noise function generates appropriately corrected values for all supported detector modes. If the marker delta function is on and the noise marker is activated and moved to measure the noise floor, the marker readout will display the signal-to-noise ratio.

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NOTE You can use **Delta** and **Marker Noise** to indicate noise level relative to sinusoidal signal (signal to noise). Activate the delta marker before pressing **Marker Noise** or the reference marker units may be incorrect.

The noise marker averages 5% of the trace data values (one-half a horizontal division), centered on the location of the marker on the frequency or time scale. Marker noise indicates noise power density per Hertz or noise voltage per root Hertz depending upon the amplitude units selected. The number of sweep points is noted in parenthesis to the right of the sweep time in the lower right corner of the graticule.

Note that the data values averaged will not always be symmetrical with respect to the marker position. If the marker is positioned within 2.5% of the beginning of the trace (one-quarter division), the trace data values in the first half-division will be averaged. Similarly, if the marker is positioned within 2.5% of the end of the trace, the trace data values in the last half-division will be averaged.

NOTE Do not use Marker Noise to evaluate the displayed average noise level of the analyzer relative to the specification. Read the displayed average noise level directly from the display or use the normal marker. Refer to Application Note 150 for a discussion of how noise is displayed on a spectrum analyzer.

To guarantee accurate data for noise-like signals, a correction for equivalent noise bandwidth for each resolution bandwidth is measured and included in the measurement. The Marker Noise function accuracy is optimal when the detector is set either to Average or to Sample because neither of these detectors peak-biases the noise.

Key Access: **Marker**, **More**, **Function**

Off Turns off the active function markers.

Key Access: **Marker**, **More**, **Function**

Marker Table On Off Compresses the graticule and displays marker information in a table. The information includes the marker number, trace number, marker type, X axis value, and the amplitude.

Key Access: **Marker**, **More**

Marker All Off Turns off all of the markers, including markers used for signal track and demodulation. Marker annotation is also removed.

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Marker →

Accesses the following marker function menu keys:

Mkr → CF Sets the center frequency of the analyzer to the marker frequency. In Delta mode, **Mkr → CF** sets the center frequency to the marker delta value. **Mkr → CF** is not available in zero span.

NOTE When the frequency scale is in log mode, the center frequency is not at the center of the display.

Key Access: **Marker →**

Mkr → CF Step Changes the center-frequency step size to match the value of the active marker. Press **Frequency** then **CF Step Auto Man** to view the step size. If marker delta is active, the step size will be set to the frequency difference between the markers. This function can be used to step from one signal harmonic to another. **Mkr → CF Step** is not available in zero span.

Key Access: **Marker →**

Mkr → Start Changes the start frequency so that it is equal to the frequency of the active marker. In Delta mode, **Mkr → Start** sets the start frequency to the marker delta value. **Mkr→ Start** is not available in zero span.

Key Access: **Marker →**

Mkr→ Stop Changes the stop frequency so that it is equal to the frequency of the active marker. In Delta mode, **Mkr → Stop** sets the stop frequency to the marker delta value. **Mkr → Stop** is not available in zero span.

Key Access: **Marker →**

Mkr Δ → Span Sets the start and stop frequencies to the values of the delta markers. The marker is then set to normal at the center frequency. **Mkr Δ → Span** is not available if the marker is off, or in zero span.

Key Access: **Marker →**

NOTE The above menu keys are not available when **Segmented (On)** is selected.

Mkr → Ref Lvl Changes the reference level to the active marker value, moving the marked point to the reference level (top line of the graticule). In Delta mode, **Mkr → Ref Lvl** sets the reference level to the amplitude difference between the markers. (For example, if the difference is –15 dB, the reference level will be set to –15 dBm.)

Key Access: **Marker →**

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MEASURE (Spectrum Analysis Mode)

In the Spectrum Analysis mode (see the **Mode** key), this key displays a menu that lets you make transmitter power measurements such as adjacent channel power, occupied bandwidth, and harmonic distortion measurements, refer to Volume 2, *One-Button Power Measurements User's and Programmer's Reference* for more information about these measurements. If other modes are available and have been selected, the measurements for that particular mode will be displayed. Some common settings can be made for these measurements using the function under the **Mode Setup** key. For example, you may select one of several radio standards available by pressing **Mode Setup**, **Radio Std**.

NOTE

The measurements described in Volume 2, *One-Button Power Measurements User's and Programmer's Reference* are available in SA mode (see **Mode** key). Other measurements are available in other modes if an optional personality is installed, use the appropriate user's guide for information about those modes.

Meas Setup

Displays the setup menu for the currently selected measurement. The **Meas Setup** menu choices depend on the currently selected Mode and Measurement. This menu is empty if no measurement is active. No measurement is active if **Meas Off** is selected in the **Measure** menu.

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Meas Control

If a measurement is active, then this key accesses a menu to pause, resume, or restart one of the measurements available in the **MEASURE** key menu. **Meas Control** also allows you to select between continuous and single sweeps/measurements.

Press **MEASURE** and then select one of the available measurements. Once the desired measurement is selected, press **Meas Control**. **Meas Control** accesses the following keys:

Restart

Performs the same functions as the "Restart" front-panel key.It repeats your measurement from the beginning. Pressing **Restart** while a measurement is being made will halt the current measurement at the first possible stopping point and repeat the measurement.

Key Access: **Meas Control**

Measure Single Cont

Measure (Single) takes one measurement sweep and display the measurement results. **Measure (Cont)** allows you to continuously run a measurement, displaying the results after each measurement cycle.

Key Access: **Meas Control**

Pause

Pauses the measurement. Pressing **Pause** will toggle between pausing and resuming your measurement. The key label will toggle between **Pause** and **Resume**. If an averaged measurement was in progress, the average counter is frozen and the measurement sweeping is halted.

Key Access: **Meas Control**

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MODE

Selects the measurement mode of your analyzer. **Spectrum Analysis** mode is the default mode and is for general purpose measurement use. Additional measurement modes can be added to your instrument memory. Example modes include Phase Noise (requires Option 226), Noise Figure (requires Option 219), GSM (requires Option BAH) and cdmaOne (requires Option BAC).

Other modes, besides Spectrum Analysis, must be installed/licensed in your instrument before they will appear in the **Mode** menu. Refer to the individual measurement personality mode manuals for instructions on how to install the firmware. Some modes also require the presence of specific hardware.

Spectrum Analysis Selects the spectrum analysis measurement mode for your analyzer.

Mode Setup (Spectrum Analysis Mode) Enables you to change measurement settings common to *all* measurements in the **MEASURE** menu. In Spectrum Analysis mode, there are several built-in power measurements. Parameters that you set in the Mode Setup menu affect all of these measurements, see Volume 2, *One-Button Power Measurements User's and Programmer's Reference* for more information.

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Next Window

Allows you to select the active window in functions which support split-screen display modes, such as zone span. In split-screen display modes, pressing **Zoom** allows you to switch between split-screen and full-sized displays of the active window. See also “Zoom”.

NOTE The active window is indicated by a solid green box around the window.

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Peak Search

Places a marker on the highest peak based on the settings of the Search Criteria on page 117. Refer to Peak Search Type on page 118, for more information on the effect of setting **Peak Search Type** to **Max Value** or **Excursion & Threshold**. When you preset the analyzer, the **Peak Search Type** is set to **Max Value** unless you save **Peak Search Type** (Excursion & Threshold) as part of the user preset conditions and set **Preset** to **User**. Refer to Preset on page 120, for more information on presetting the analyzer.

NOTE

All peak search functions ignore the LO feedthrough. The process for determining if the Peak is the LO feedthrough takes into account Start Frequency, Span, Resolution Bandwidth, Resolution Bandwidth shape factor, and Frequency Accuracy. If there is no point of inflection within the LO feedthrough range, the point on the trace with maximum amplitude, that is higher in frequency than the LO feedthrough range, will be selected. Peak Search may locate the LO feedthrough when **FREQUENCY**, **Scale Type** (Log) is selected.

Meas Tools

Accesses the following frequently used menu keys which are replicated here for your convenience.

Peak Search Performs peak search as described above.

Key access: **Peak Search**, **Meas Tools**

Next Pk Right Refer to "Next Pk Right" on page 116.

Key access: **Peak Search**, **Meas Tools**

Next Pk Left Refer to "Next Pk Left" on page 116 of this chapter.

Key access: **Peak Search**, **Meas Tools**

Delta Refer to "Delta" on page 105.

Key access: **Peak Search**, **Meas Tools**

Mkr → CF Refer to Mkr → CF on page 120.

Key access: **Peak Search**, **Meas Tools**

Mkr → Ref Lvl Refer to Mkr → Ref on page 121.

Key access: **Peak Search**, **Meas Tools**

Function Refer to "Function" on page 107.

Key Access: **Peak Search**, **Meas Tools**

Band Power Refer to "Band Power" on page 107.

Key Access: **Peak Search**, **Meas Tools**, **Function**

Marker Noise Refer to "Marker Noise" on page 108.

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Key Access: **Peak Search**, **Meas Tools**, **Function**

Off — Refer to "Off" on page 106.

Key Access: **Peak Search**, **Meas Tools**, **Function**

Next Peak — Places the marker on the next highest peak. The signal peak must exceed the peak threshold value by the peak excursion value. If there is no peak, the marker will not move. (Also see the **Peak Excursion** and **Peak Threshold** key descriptions.)

Key Access: **Search**

Next Pk Right — Moves the marker to the next peak to the right of the current marker. The signal peak must exceed the peak threshold value by the peak excursion value. If there is no peak to the right, the marker will not move and the **`No Peak Found`** error message will appear on the display. (Also see the **Peak Excursion** and **Peak Threshold** key descriptions.)

Key Access: **Search**

Next Pk Left — Moves the marker to the next peak to the left of the current marker. The signal peak must exceed the peak threshold value by the peak excursion value. If there is no peak to the left, the marker will not move and the **`No Peak Found`** error message will appear on the display. (Also see the **Peak Excursion** and **Peak Threshold** key descriptions.)

Key Access: **Search**

Min Search — Moves the active marker to the minimum detected amplitude value.

Key Access: **Search**

Pk-Pk Search — Finds and displays the frequency (or time, if in zero span) and amplitude differences between the highest and lowest trace points.

Key Access: **Search**

Continuous Pk On Off — When a marker is placed on a signal and **Continuous Pk (On)** is pressed, the marker will remain on the signal even if the signal frequency changes, as long as the amplitude of the signal does not change by more than 3 dB from one sweep to another.

If the signal is lost, an attempt will be made to find it again and maintain the marker on the signal peak. If there are other signals on screen near the same amplitude, one of them may be found instead. Signals near 0 Hz cannot be maintained effectively, because they cannot be distinguished from the LO feedthrough, which is excluded by intent from the search algorithm.

NOTE This function is intended to maintain the marker on signals with a frequency that is changing, and an amplitude that is not changing.

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Key Access: **Search**, **More**

N dB Points On Off

Activates the N dB function. Pressing **N dB Points (On)** turns on the N dB feature and activates two arrows that are N dB down from the marker. The frequency difference between the two arrows will be displayed in the upper right-hand corner of the display. If the feature is unable to find data N dB below the marker, the value of –100 Hz will be displayed in the upper right-hand corner of the display.

For example, N dB Points can be used to measure the 3 dB bandwidth of a filter in a transmission test with the tracking generator. The default value is –3 dB. Possible values range from –1.00 dB to –80.00 dB. You can enter values to a resolution of 0.01 dB using the numeric key pad, 0.1 dB using the knob, or 10 dB using the step keys.

The N dB function follows the active marker. If you turn on a marker after N dB Points has been activated, the arrows will follow that marker. If the marker associated with N dB Points moves, the arrows will move with the marker unless there is no data N dB below the marker.

Key Access: **Search**, **More**

Search Criteria

Accesses the following menu keys:

Key access: **Search**, **More**

Peak Excursion

Sets the minimum amplitude variation of signals that the marker can identify as a peak. If a value of 10 dB is selected, the marker moves only to peaks that rise and fall more than 10 dB above the peak threshold value. Pressing **Preset** (when **Preset Type** is set to **Factory**) or turning on power resets the excursion to 6 dB and the threshold to 90 dB below the reference level.

NOTE

Two signal peaks, which are so close together that the amplitude drop between them is less than the peak-excursion value, are not recognized as two peaks. A signal peak is recognized only if it has a peak excursion drop above the noise floor, on both sides of the signal.

When the peak excursion value is 6 dB or higher, the marker-peaking functions do not recognize signals less than the peak excursion value above the noise floor. To correct this, when measuring signals near the noise floor, the excursion value can be reduced even further. To prevent the marker from identifying noise as signals, reduce the noise floor variance to a value less than the peak-excursion value by reducing the video bandwidth or by using video averaging.

Key access: **Peak Search**, **More**, **Search Criteria**

Peak Threshold

Sets the minimum amplitude of signals that the marker can identify as a peak. For example, if a value of –90 dBm is selected, the marker moves only to peaks that rise and fall more than the peak excursion value above –90 dBm. Pressing **Preset**

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or turning the Power on resets the excursion to 6 dB and the threshold to –90 dBm.

The value of the threshold appears in the active-function block and on the lower-left side of the display. The threshold level does not influence the trace memory or marker position. The value of the peak threshold level can be changed using the step keys, the knob, or the numeric keypad. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu.

Key access: **Peak Search**, **More**, **Search Criteria**

Peak Search Type

Allows you to select the peak search mode.

Key access: **Peak Search**, **More**, **Search Criteria**

Max Value

When **Peak Search Type** is set to **Max Value**, a peak search places a marker on the highest peak, excluding the LO feedthrough peak.

Key Access: **Peak Search**, **More**, **Search Criteria**, **Peak Search Type**

Excursion & Threshold

When **Peak Search** is set to **Excursion & Threshold**, a peak search places a marker on a peak that meets the **Peak Excursion** and **Peak Threshold** parameters. If **Peak Search Type** is set to **Excursion &Threshold** and no peak satisfies the selected parameters, a marker is placed at the center of the trace, and the error message, **`No Peak Found`** will appear. Refer to Show Errors on page 151, to remove the error message.

Key Access: **Peak Search**, **More**, **Search Criteria**, **Peak Search Type**

Peak Table

Accesses the following **Peak Table** menu keys:

Key Access: **Peak Search**, **More 1 of 2**

Peak Table On Off

Displays a list of up to ten signal peaks that is updated at the end of each sweep. The peaks can be sorted in order by descending amplitude or by ascending frequency. Peaks above or below the display line can be excluded from the table. The peak table function works with trace 1 only.

Key Access: **Search**, **More**, **Peak Table**

Peak Sort Freq Amptd

Switches the peak table sorting routine between listing the peaks

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in order by descending amplitude or by ascending frequency.

Key Access: **Search**, **More**, **Peak Table**

Peak Readout Accesses the following **Peak Readout** menu keys:

Key Access: **Search**, **More**, **Peak Table**

Normal

Shows up to ten signal peaks.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

> Display Line

Shows only peaks above the display line.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

< Display Line

Shows only peaks below the display line.

Key Access: **Search**, **More**, **Peak Table**, **Peak Readout**

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Preset

Provides a known convenient starting point of the instrument state for making measurements. You can select whether a user preset, mode preset, or factory preset is performed. When you press **Preset**, the default is **Mode** preset, which will set the analyzer to the default state for the current mode. The user preset is user-defined using the **Save User Preset** function in the **System** menu (Press **System**, **Power On/Preset**, **Save User Preset**.) The **Preset Type** selection (**User**, **Mode** or **Factory**) can be set by pressing **System**, **Power On/Preset**, **Preset Type.**

NOTE The **Preset** menu keys are only available when the **Preset Type** key in the **System** menu is set to **User**. Press **System**, **Power On/Preset**, **Preset Type**, **User**.

If **Preset Type** is set to **Factory** in the **System** menu:

Pressing the **Preset** front-panel key performs a factory preset, which performs the following:

- Resets the analyzer to Spectrum Analyzer (SA) mode.
- Brings up the **Freq/Channel** menu.
- Sets certain conditions to their default values.
- Performs a processor test, but does not affect alignment data.
- Clears both the input and output buffers and clears all trace data.
- Sets the amplitude values of trace 2 and 3 to the bottom of the screen.
- Amplitude-correction factors are turned off, but remain in analyzer memory.
- Limit line testing is turned off, but the limit line tables remain in analyzer memory.
- Segmented sweep is turned off, but the segmented sweep tables remain in analyzer memory.
- The status byte is set to 0.

See Table 2-2 on page 121 for the conditions established by performing a factory preset.

NOTE For *Agilent E4402B or E4407Bwith Option UKB, E4404B, and E4405B* only, you can specify alternating current (ac) or direct current (dc) coupling at the analyzer input. Selecting ac coupling blocks any dc voltage at the analyzer input, but also decreases the frequency range of the analyzer. Make sure the analyzer is dc coupled when measuring below 100 kHz for ***Agilent E4402B, E4404B, and E4405B*** and below 10 MHz for *Agilent E4407B*. (See "Input/Output" in this chapter for more information on this setting.)

If **Preset Type** is set to **User** in the **System** menu:

Pressing the **Preset** front-panel key brings up the **User Preset**, **Mode Preset**, and **Factory Preset** menu keys.

- If **User Preset** is pressed, the user preset state is recalled. To set the user preset state, change the analyzer settings as desired, then press **System**, **Power**

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On/Preset, **Save User Preset**.

- If **Mode Preset** is pressed, the current mode settings are reset to the factory defaults. Pressing **Mode Preset** does not change the mode.
- If **Factory Preset** is pressed, a factory preset will be performed as described above.

NOTE Recalling any state, including the user preset state, will affect the conditions of more parameters than are affected by a factory preset. For example, external preamp gain and input impedance correction are not affected by a factory preset but may be affected by a user preset.

NOTE In the **System** menu, if **Power On** is set to **Preset**, and **Preset Type** is set to **Factory**, turning on the analyzer performs a factory preset. The last state of the analyzer (before it was turned off) is recalled if **Power On** is set to **Last**. The user preset state is recalled if **Power On** is set to **Preset** and **Preset Type** is set to **User**.

Table 2-2 Factory Preset Conditions

Amplitude correction factors	off
Amplitude Ref (Signal)	off
Amplitude units	50 Ω input – dBm log 75 Ω input – dBmV log
Annotation and graticule display	on
Attenuation	10 dB (auto-coupled)
Center frequency: E4401B and E4411B E4402B and E4403B E4404B E4405B E4407B and E4408B	 750 MHz 1.5 GHz 3.35 GHz 6.6 GHz 13.25 GHz
CF step size	10% of span
Coupled functions	all set to AUTO
Detector	Peak (auto-coupled)
Display line level	–25 dBm, display off
Frequency (scale type)	Linear
Frequency offset	0 Hz
IF Gain	Auto

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Table 2-2 Factory Preset Conditions (Continued)

Input Coupling[1] E4402B & E4407B with Option UKB, E4404B, and E4405B	AC
Int Preamp	off
Limit line testing	off
Log scale (Amplitude)	10 dB/division
Marker count	off
Marker counter resolution	auto-coupled
Markers	off
Max Mixer level	–10 dBm
Measure	Meas Off
Radio Std	None
Reference level	0 dBm in power-on units
Reference level offset	0 dB
Reference level position	top (10th) graticule
Resolution bandwidth	3 MHz (auto-coupled)
Span E4401B and E4411B E4402B and E4403B E4404B E4405B E4407B and E4408B	 1.5 GHz 3.0 GHz 6.7 GHz 13.2 GHz 26.5 GHz
Speaker	Off
SRQ mask	40
Start Frequency	0 Hz
Stop Frequency E4401B and E4411B E4402B and E4403B E4404B E4405B E4407B and E4408B	 1.5 GHz 3.0 GHz 6.7 GHz 13.2 GHz 26.5 GHz
State Registers	unaffected

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Table 2-2 Factory Preset Conditions (Continued)

Segmented Sweep	off
Sweep Points	continuous
Sweep Time E4401B and E4411B E4402B and E4403B E4404B E4405B E4407B and E4408B	 4 ms (auto coupled) 5 ms (auto coupled) 16.75 ms (auto coupled) 33 ms (auto coupled) 265 ms (auto coupled)
Sweep	401
Threshold level	–90 dBm, display off
Title	cleared
Trace 1	clear-write
Trace 2	blank, at bottom of display
Trace 3	blank, at bottom of display
Trigger	free run
Trig Delay Off	1 µsec
Trig Offset Off	0 sec
VBW/RBW ratio	1.000 X (auto-coupled)
Video averaging	off
Video bandwidth	3 MHz (auto-coupled)

1. E4401B, E4402B without Option UKB, E4403B, and E4411B have fixed AC coupling. E4407B without Option UKB and E4408B have fixed DC coupling.

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User Preset

This key is only available when the **Preset Type** key is set to **User**. Press **System**, **Power On/Preset**, **Preset Type**, **User**.

User Preset loads the analyzer configuration that existed when **Save User Preset** was pressed. If **Save User Preset** has never been pressed, the factory preset state is loaded. If the user preset state has been saved but the load fails for any reason, the error message: `Unable to load user state` is displayed in the status line and the state is reset to whatever it was before the **Preset** key was pressed. This can sometimes happen if firmware has been upgraded or applications have been (un)installed after the user preset state was saved. **Save User Preset** can be accessed by pressing **System**, **Power On/Preset**.

Key Access: **Preset**

Mode Preset

This key is only available when the **Preset Type** key is set to **User**. Press **System**, **Power On/Preset**, **Preset Type**, **User**.

Mode Preset does not change the mode. It only resets the current mode settings to the factory defaults and to continuous sweeps/measurements.

Key Access: **Preset**

Factory Preset

This key is only available when the **Preset Type** key is set to **User**. Press **System**, **Power On/Preset**, **Preset Type**, **User**.

A factory preset is executed so all of the instrument modes are returned to the factory default state (i.e. Spectrum Analysis Mode and continuous sweep.) If you are not already in the spectrum analysis mode, it switches to that mode. A factory preset will not reset “persistent” functions such as GPIB address, time/date display style, or auto alignment state to the factory defaults.

Key Access: **Preset**

Save User Preset

This key is only available when the **Preset Type** key is set to **User**. Press **System**, **Power On/Preset**, **Preset Type**, **User**.

This key saves the current state of the analyzer into the **User Preset** state for recalling when the instrument is user preset. After you save a state here, you must go to the **Preset Type** key and select **User** in order to have this state used as the preset state.

Key Access: **Preset**

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Print

Option A4H (GPIB and Parallel) or Option 1AX (RS-232 and Parallel) only. **Print** initiates an output of the display data, without an external controller, to a previously specified graphics printer. Refer to “Printer Setup and Operation” in your Getting Started or Programmer’s Guide for detailed information about printing.

Press the **Print** key to immediately print the screen to the currently-defined printer. The screen remains frozen (no further sweeps are taken) until the data transfer to the printer is complete. Refer to the **Print Setup** key description in this chapter for more information about the structure and definitions of the printer keys.

If you need to abort a print in progress, use the **ESC** (escape) key.

NOTE Printing requires an I/O interface. The *Agilent ESA Spectrum Analyzers Programmer’s Guide*, included with the optional interfaces, provides interface details. Refer to “Printer Setup and Operation” in the *Agilent ESA Spectrum Analyzers Getting Started Guide* for more information about printing.

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Print Setup

Option A4H (GPIB and Parallel) or 1AX (RS-232 and Parallel) only. Accesses the menu keys which allow you to define a printer and select printer options.

Printer Type

Accesses the Printer Type menu keys. When you connect your printer and press the **Print** key, the analyzer will attempt to identify your printer. If identification is unsuccessful, **None** or **Custom** will automatically be set in the Printer Type menu.

Key Access: **Print Setup**

None

The Printer Type will automatically be set to **None** when you press the **Print** key with an unsupported printer connected to your analyzer.

Key Access: **Print Setup**, **Printer Type**

Custom

When you press the **Print** key and the analyzer cannot identify your printer, **Custom** will automatically be set in the Printer Type menu. Setting the Printer Type menu key to **Custom** allows you to define your printer using the **Define Custom** menu keys.

Key Access: **Print Setup**, **Printer Type**

Auto

When **Auto** is selected, and the **Print** key is pressed, the analyzer will attempt to communicate with the printer and obtain its identification. If the printer is identified, the print will be successful and no message will appear on the display. If the analyzer is not able to identify the printer, the Printer Type will automatically be set to **Custom** and an error message asking you to press **Define Custom** to set up your printer will be displayed. If the printer is not supported, the Printer Type will automatically be set to **None** and an error message will inform you that your printer is unsupported.

Key Access: **Print Setup**, **Printer Type**

Define Custom

Allows you to define your printer.

Key Access: **Print Setup**, **Printer Type**

Language

PCL3 PCL5

Allows you to define your printer as a Hewlett-Packard PCL3. (Most DeskJets) or Hewlett-Packard PCL5 (LaserJets and DeskJets: 1100,1200,1600,2000 series) printer.

Key Access: **Print Setup**, **Define Custom**

Color Capable

Yes No

Allows you to define the color capability of your printer.

Key Access: **Print Setup**, **Define Custom**

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Orientation

Allows you to select either **Portrait** or **Landscape** printing. The **Orientation** key will not function with a PCL3 (HP DeskJet) printer.

Key Access: **Print Setup**

Prints/Page
1 2

Selects the number of prints per page when orientation is set to **Portrait**. In **Landscape** printing, **Prints/Page** is always set to 1.

Key Access: **Print Setup**

Eject Page

Ejects your printed page.

Key Access: **Print Setup**

Page Size

Allows you to select from the following page sizes: **Executive**, **Letter**, **Legal**, **Ledger**, **A4**, and **A3**.

Key Access: **Print Setup, More**

Color
On Off

Allows you to select between color or black and white printing. This key will not function when pressed unless the connected printer supports color.

Key Access: **Print Setup**, **More**

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Restart

If no measurement is active and **Sweep (Single)** is selected, a new sweep is initiated. When in **Average (On)** mode, (**BW/Avg**, **Average**) the averaging function is restarted (the trace is reset and the average number is reset to zero).

If a one-button measurement is selected, it restarts a previously paused measurement at the beginning. If the measurement is active, it will stop it as soon as possible and restart it from the beginning.

Key Access: Front-panel key. It can also be found under **Meas Control**.

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Return

Returns you to the previous menu. Repeated presses of this key move back through previously selected menus (including previous pages selected by the **MORE** key.

NOTE When a menu requiring a yes or no key press has been accessed, the **Return** key will not respond.

NOTE When entering an alphanumeric value (a screen title or filename), pressing **Return** terminates the entry.

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Save

Executes a save operation as though you were in the **File**, **Save** menu and had pressed **Save Now**. If you have previously used the **File**, **Save**, **Save Now** keys to setup and save a file, the **Save** hardkey will save your file in the same format and to the same location using a new automatically generated filename. If you have not saved a file since power on, a state file (.STA format) will be saved to the C: drive.

For example, if you use the **File**, **Save** menu to configure the analyzer to save Trace 1 in .CSV format on the C: drive, using the automatically generated file name (TRACE001.CSV), then every time the front panel **Save** key is pressed, Trace 1 will be saved in .CSV format and the filename will be incremented (TRACE002.CSV, TRACE003.CSV). This provides a convenient format for saving several files with the same format quickly.

NOTE In the event that a valid save cannot be performed because a drive has not been selected, the **Save** key will report the error `No drive selected`. In this case, press **File**, **Save** and select a drive.

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Single

When analyzer is in continuous sweep mode and not in a measurement (**Measure**, **Meas Off**), this key changes the sweep control to single sweep and executes a sweep after the trigger condition is met. If the analyzer is already in single sweep, pressing **Single** executes a new sweep after the trigger condition is met.

If Average is on (**BW/Avg**, **Average (On)**), pressing **Single** resets the average trace and starts the average again from a count of zero. Sweeps are averaged until N sweeps are then taken (where N is the average number), and then the sweep is halted.

Some one-button measurements require more than one sweep to complete the measurement. The measurements selected from the functions under the **MEASURE** key set the trigger system to be initiated only once. In this case the trigger condition can be met only once and then all the necessary sweeps will be executed to make the measurement.

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Source

Accesses the tracking generator key functions (Options 1DN or 1DQ only). Without Option 1DN or 1DQ, pressing **Source** will cause the error message `Option not installed` to appear on the analyzer display.

CAUTION If **Auto Align** is on, the 3 GHz tracking generator will be momentarily retuned to approximately 1.557 GHz between most sweeps. Some devices under test (for example, amplifiers with AGC) may be susceptible to damage due to this momentary retuning. To avoid this momentary retuning, turn the auto align off by pressing **System**, **Alignments**, **Auto Align**, **Off**. Refer to the Specifications Guide for your instrument to learn more information about using the analyzer with Auto Align set to off.

NOTE The output frequency of the 3 GHz tracking generator may not exactly match the input frequency of the spectrum analyzer. This is probably not a problem when using wide resolution bandwidths. However, narrowing the RBW may cause a drop in the displayed signal amplitude as the frequency offset puts the signal out of the center of the RBW filter. For narrower RBWs you may need to do a tracking peak to adjust the tracking generator frequency. See the **Tracking Peak** and **Man Tracking Adjust**.

Amplitude
On Off

Activates (**On**) or deactivates (**Off**) the output power of the tracking generator. The power level can then be adjusted using the numeric keypad, step keys, or knob. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu. See the specifications chapter in the calibration guide for the available output power for your tracking generator.

Key Access: **Source**

CAUTION Power-level sensitive devices connected to the tracking generator output may be accidentally damaged. This is because the actual source amplitude will be greater than the amplitude indicated on the analyzer, when the power sweep function is being used.

The source amplitude value is used as the starting amplitude for a power sweep. The ending amplitude for a power sweep is higher then the source amplitude value and it may actually be set to values beyond specified output levels. Therefore, exercise caution when connecting a power-level sensitive device to the tracking generator output.

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NOTE For spectrum analyzers with Option 1DN or Option 1DQ, the tracking generator must be turned on (**Source**, **Amplitude (On)**) before you set up the segmented sweep table.

NOTE When **Amplitude (Off)** is selected, the output attenuation on the Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B is set to the maximum attenuation.

Power Sweep
On Off

Sets the power-sweep function to **On** or **Off**. The value of the power-sweep range is displayed in the active-function block when you press **Power Sweep (On)**. The analyzer continues to sweep the specified frequency range when power sweep is on. (To do a power sweep at a fixed frequency, set the analyzer to zero span at the desired frequency.) The available power-sweep range is a function of the source attenuator setting. For your instrument's available power sweep range refer to the appropriate Specifications Guide for your analyzer.

The output power of the tracking generator is swept according to the sweep rate of the analyzer. The output power is always swept from the source power setting to a higher power setting (negative source power sweep values are not allowed).

Power-sweep measurements are particularly useful in making gain compression measurements or output power versus frequency measurements.

CAUTION When using the power sweep functionality, the actual source amplitude will be greater than the source amplitude indicated. The source amplitude value is the starting amplitude for a power sweep, so the ending amplitude for a power sweep will be higher then the displayed value. As a result, exercise caution when connecting a power-level sensitive device to the tracking generator output.

Key Access: **Source**

Attenuation
Auto Man

Allows you to select between automatic and manual adjustment of the tracking generator's output attenuator. The Agilent E4401B and E4411B can be manually adjusted from 0 to 60 dB in 10 dB steps. All other Agilent ESA analyzers can be manually adjusted from 0 to 56 dB in 8 dB steps. When auto-coupled, the attenuation function automatically adjusts the attenuator to yield the source amplitude level specified by the **Amplitude On Off** softkey function. For the Agilent E4401B and E4411B, press **Attenuation (Man)** for power sweeps greater than 10 dB.

Key Access: **Source**

Amptd Step
Auto Man

Allows you to set the step size of the power level range of the tracking generator. The default setting is one vertical scale division when in a logarithmic amplitude scale.

Key Access: **Source**

Amptd Offset

Offsets the displayed power of the tracking generator. Using the amplitude offset

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capability of the tracking generator allows you to take system losses or gains into account, thereby displaying the actual power delivered to the device under test.

Key Access: **Source**

Normalize

Key Access: **Source**

Store Ref (1→ 3)

Copies trace 1 into trace 3. **Store Ref (1→ 3)** must be pressed before pressing **Normalize (On)**. If **Normalize (On)** is pressed before **Store Ref (1→ 3)**, the error message: `Store reference trace before turning on Normalize` is displayed in the status line, however Normalize has been activated.

Key Access: **Source**, **More**, **Normalize**

Normalize On Off

Normalize (On) Activates the normalize function. On each sweep, the normalized trace (Trace 3) is subtracted from Trace 1 and the result is added to the normalized reference level. The display shows the result of the following calculation:

Trace 1 – Normalized Trace + Normalized Reference Level

The trace data is normalized with respect to the normalized reference level, even if the value of the normalized reference level is changed. This function remains in effect on all subsequent sweeps until it is turned off.

NOTE Segmented sweep is not available when **Normalize (On)** is selected.

CAUTION Trace 1 should be in clear write mode prior to setting normalize to on.

The normalize function is most useful for applying correction data to a trace while making a stimulus response measurement with a tracking generator. For example, connect the cables and a thru line, in place of the device to be measured, between the tracking generator and the analyzer input. Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the analyzer.

Now press **Store Ref (1→ 3)**, **Normalize On**. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the thru line with the device under test, and an accurate measurement of the gain or loss can be made.

Key Access: **Source**, **More**, **Normalize**

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Norm Ref Lvl Sets the level (in dB) of the normalized reference.

Key Access: **Source**, **More**, **Normalize**

Norm Ref Posn Offsets the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be moved without decreasing measurement accuracy. The normalized reference position is indicated with a (>) character on the left side of the display and a (<) character on the right side of the display.

Key Access: **Source**, **More**, **Normalize**

Ref Trace View BLank Allows you to view or blank the reference trace on the display.

Key Access: **Source**, **More**, **Normalize**

Tracking Peak *Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only*. Activates a routine that automatically adjusts fine frequency tracking to obtain the peak response of the tracking generator on the spectrum analyzer display. Tracking Peak is performed in the current resolution bandwidth.

The output frequency of the tracking generator is not exactly matched to the input frequency of the spectrum analyzer which causes tracking error. As you narrow the resolution bandwidth (RBW) you may see the displayed signal level decrease. This is because a frequency offset means the signal will not be at the center of the analyzer's RBW. The tracking peak process will minimize this error. It can be done automatically with **Tracking Peak** or manually with **Man Track Adj**. (With very narrow RBWs, the manual process may be faster.)

Tracking error is more of a problem when using narrow RBWs or testing a device under test (DUT) with high Q. With a high Q DUT, the tracking generator signal may need to be connected directly to the input of the analyzer, rather than through the DUT, while you do the tracking peak. For the best measurement accuracy, a tracking peak should be done whenever you reduce the analyzer RBW (especially if the amplitude decreases).

Key Access: **Source**, **More**

Man Track Adj *Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B only*. Allows you to adjust the frequency of the tracking generator oscillator manually using the step keys, knob, or numeric keypad. The tracking adjust is tuned to maximize the amplitude of the trace.

Key Access: **Source**, **More**

NOTE When **Source** is On, resolution bandwidths < 1 kHz are not available.

When the resolution bandwidth is < 1 kHz, **Source** may not be turned on.

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SPAN X Scale

NOTE This menu may change if one-button measurements are selected. Some measurements will alter the **Span X** menu keys to make the measurement easier to use.

Activates the **Span** function and accesses the menu of span functions. Pressing **SPAN X Scale** allows you to change the frequency range symmetrically about the center frequency. The frequency-span readout describes the total displayed frequency range. To determine frequency span per horizontal graticule division (when the frequency scale type is set to linear), divide the frequency span by 10.

Span Allows you to enter a span frequency range value.

Key Access: **SPAN X Scale**

Span Zoom Performs an automatic zoom so that the signal at the marker remains at the center of the display. If a marker is already on, the zoom begins at the frequency of the marker. If a marker is not already on, a marker is placed on the highest on-screen signal (ignoring the LO feedthrough). Signal-track is turned on, and the span function is activated. Entering a new span value causes the analyzer to change the span in steps, keeping the signal centered on the screen until the desired span is reached. The analyzer is left in Signal Track mode. Pressing **Span Zoom** performs the routine similar to pressing the following keys: **Search**, **Frequency**, **Signal Track (On)**, and **Span**.

NOTE **Span Zoom** is not available when the **Frequency**, **Scale Type (Log)** is selected.

NOTE Span Zoom leaves the analyzer in Signal Track mode.

NOTE Span Zoom is not available when **Segmented (On)** is selected.

Key Access: **SPAN X Scale**

Full Span Changes the analyzer span to full span showing the full frequency range of the analyzer. In external mixing mode, pressing **Full Span** changes the analyzer span to the specified range for the selected external mixing band. Full span sets **Signal Track (Off)** and **Segmented (Off)**.

Key Access: **SPAN X Scale**

Zero Span Changes the frequency span to zero. In this mode, the current center frequency is displayed in the time domain (the x-axis is displayed in units of time), like a conventional oscilloscope.

Sweep times faster than those in the frequency domain display mode are available if Option AYX or B7D are installed.

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Resolution Bandwidths less than 1 kHz are unavailable when in zero span if the sweep time is being achieved by utilizing the Option AYX or B7D.

Key Access: **SPAN X Scale**

NOTE Sweep times that would require Option AYX or Option B7D are not available in zero span if the Resolution Bandwidth is less than 1 kHz.

NOTE Zero Span is not available when **Segmented (On)** is selected. Segments in the segmented sweep function can be set to zero span by setting the span parameter in the segmented sweep editor to 0 Hz. (**Sweep, Segmented, Modify, Edit, Span**)

NOTE The minimum number of sweep points in zero span varies with firmware revision:

Firmware Revision	Minimum # of Sweep Points in Zero Span
≤ A.03.03	401 (fixed)
A.04.xx	101
≥ A.05.00	2

NOTE Zero Span sets **Signal Track (Off)** and **FREQUENCY, Scale Type** to linear mode.

Last Span Changes the analyzer frequency span to the previous span setting. If pressed after **Signal Track** is turned off, the span setting returns to the span that was in effect before **Signal Track** was turned on. This is true, even if **Signal Track** was turned on as part of **Span Zoom**. Last span sets **Segmented (Off)**. The state of **Frequency, Scale Type Log Lin** is included in the recalled information.

Key Access: **SPAN X Scale**

Zone Accesses menu keys that allow you to control the two-window zone function. This function allows you to have an upper window with a broad display of frequency and two zone markers (vertical bars) that define the span for the lower window.

Key Access: **SPAN X Scale**

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Zone On Off

Zone (On) allows you to change from a one-window to a two-window display. The top window will display the trace with two vertical lines (Zone Markers) displayed at center frequency plus and minus 5% of the current span. (You can change the default zone frequency and zone span values using the **Zone Center** and **Zone Span** keys.) The top window will be inactive.

The bottom window will display the section of the trace in the top window that is between the Zone Markers. The span of the bottom window is 10% of the span of the top window. (You can change the default zone frequency and zone span values using the **Zone Center** and **Zone Span** keys.) When first activated, both windows have the same center frequency. The bottom window is active and the sweep time, resolution bandwidth, and video bandwidth have been coupled to the bottom window span.

There are separate annotations for frequency, bandwidth, sweep time, reference level, amplitude scale and scale/div for each window. The values for these parameters can be changed for each window independently.

To activate the top window, press the **Next Window** key located below the display. The active window is distinguished by a green border. Only the active window will have a sweep taken and updated to the display. When the active window is toggled, the state for the active window is saved, and the last state of the inactive window is recalled. When the window becomes inactive, its data invalid indicator will appear on the display. The data invalid indicator will remain until the window becomes the active window and a complete sweep has been executed. Pressing **Zoom** will change to a one-window display showing only the active window. Pressing **Zoom** again will return you to the two-window display. Pressing **Zone (Off)** will return you to a one-window display of the active window.

Key Access: **SPAN X Scale**, **Zone**

NOTE Pressing **Zoom** will set **Zone (On)**, if it is off.

Zone Center

Allows you to change the frequency of the zone markers without changing the zone span. The zone markers are vertical lines marking the zone in the upper window. They determine the frequency range displayed in the lower window. As the zone markers in the upper window are moved, the center frequency of the lower window is changed but the lower window will not be updated to reflect the change unless it is selected as the active window. (See **Zone On Off**.)

The center frequency for the lower window is not limited by the

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selected start and stop frequencies in the upper window. However, if the frequency span of the lower window is outside of the span for the upper window, the vertical span markers will be displayed at the edge of the graticule. When the lower window is active, the **FREQUENCY Channel** key will allow you to change **Zone Center**. Any change to the lower window while it is active will change the center frequency.

Key Access: **SPAN X Scale**, **Zone**

Zone Span

Allows the span of the zone markers to be changed without changing the center frequency. The zone markers are vertical lines marking the zone in the upper window. They determine the frequency range displayed in the lower window. As the zone markers are moved, the span of the lower window is changed but the lower window will not be updated to reflect the change unless it is selected as the active window.
(See **Zone On Off**.)

The span limit of the lower window is the same as the span limit of the analyzer. The span for the lower window is not limited to the selected span of the upper window. However, if the frequency span of the lower window is outside of the span of the upper window, the vertical span markers will not be displayed. When the lower window is active, the **SPAN X Scale** key will change **Zone Span**, and any change to **Zone Span** while the lower window is active, will change the span.

Key Access: **SPAN X Scale**, **Zone**

NOTE Zone Span is not available when **Segmented (On)** is selected.

Zone Pk Right

Finds the next peak to the right of the zone center frequency on the upper window trace and then moves the zone so that it is centered around the new peak. The zone span is not changed. The center frequency of the lower window changes to reflect the new zone center frequency. The lower window will not be updated until it is made active. If no peak is found, the zone will not be moved. A signal must obey the parameters defined in **Search**, **Search Param** to be identified as a peak signal. Pressing **Zone Pk Right** will have no effect if the upper window is not the active window or if it is in zero span.

Key Access: **SPAN X Scale**, **Zone**

Zone Pk Left

Finds the next peak to the left of the zone center frequency on the upper window trace and then moves the zone so that it is centered around the new peak. The zone span is not changed. The center frequency of the lower window changes to reflect the new zone center frequency. The lower window will not be updated until it is made active. If no peak is found, the zone will not be moved. A signal must obey the parameters defined in

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Search, **Search Param** to be identified as a peak signal. Pressing **Zone Pk Left** will have no effect if the upper window is not the active window or if it is in zero span.

Key Access: **SPAN X Scale**, **Zone**

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Standby

Removes power from the analyzer, except for a small portion of circuitry inside the switching power supply. No internal time base circuitry, or any other function outside of the power supply is powered when the analyzer is in “standby.”

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Sweep

Activates the sweep time function and accesses the following menu keys:

Sweep Time
Auto Man

Selects the length of time the analyzer takes to tune across the displayed frequency span (or, in zero span, the time the analyzer takes to sweep the full screen). Reducing the sweep time increases the sweep rate. The sweep time can be changed using the step keys, the knob, or the numeric keypad.

In non-zero spans:

When the sweep time is auto-coupled, the analyzer selects the optimum (shortest) sweep time for the current settings. This selection process is influenced by several factors:

- The maximum tuning rate of the spectrum analyzer
- The selected Resolution Bandwidth and Video Bandwidth filters
- The maximum sample rate of the Analog-to-Digital converter (ADC) (Trace data are digitized and stored in memory)
- The number of trace points (**Sweep, Points**)
- The Amplitude Scale (logarithmic or linear)
- The Detector mode

You may select a sweep time less than the auto-coupled value; however this may generate measurement errors. If this happens, the error message: **`Meas Uncal`** will appear in the upper right corner of the display. When the **Average** detector is selected and the amplitude scale is linear, the fastest sweet time is 8 milliseconds.

In zero span:

The minimum sweep time is determined by the maximum sample rate of the ADC and the number of sweep points. With Option B7D, the fastest sweep time is 2.5 microseconds (with 101 sweep points). As the number of points increases, the sweep time increases. With Option AYX, the fastest sweep time is 5 microseconds (with 101 sweep points). With neither option installed, the fastest sweep time is 1 millisecond (with 101 sweep points) and 4 milliseconds (with 401 sweep points). When the **Average** detector is selected and the amplitude scale is linear, the fastest sweet time is 8 milliseconds.

NOTE

With firmware A.08.00 and greater, in zero span, the auto/manual function of this key is not applicable. When **Sweep Time (Auto)** is selected in non-zero span, any changes to Sweep Time while in zero span will revert to the Auto value when you return to non-zero span. When **Sweep Time (Man)** is selected in non-zero span, any changes to Sweep Time while in zero span will be maintained when you return to non-zero span.

The maximum sweep time is 4000 seconds for any set of conditions. Refer to your instrument's appropriate Specifications Guide for more information about Sweep Time and its relation to other instrument settings.

Key Access: **Sweep**

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Sweep
Single Cont

Switches the analyzer between the continuous-sweep mode and the single-sweep mode. Pressing **Sweep (Single)** puts the analyzer in single-sweep mode. Press **Single** on the front panel, to enable a sweep when in single-sweep mode. When **Sweep (Cont)** is selected, one sweep follows another as soon as it is triggered. Pressing **Preset** (When **Preset Type** is set to **Factory**) or turning the power on, sets the sweep mode to continuous sweep.

Key Access: **Sweep**

Auto Swp Coupling
SR SA

Selects stimulus-response (SR) or spectrum-analyzer (SA) (default) auto-coupled sweep times. In stimulus-response mode, auto-coupled sweep times are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test.

Key Access: **Sweep**

Gate

Requires Option 1D6 (Time Gate). Accesses the following menu keys that allow you to setup various gate parameters:

Key Access: **Sweep**

Gate On Off

Requires Option 1D6 (Time Gate). Turns the gate function on and off. When set to **Gate (On)**, the video signal that is digitized is controlled by the gate circuitry. The gate circuitry switches between two states. When the gate is "open", the normal video signal of the analyzer is passed through the video filters to the peak detectors and digitizer of the analyzer. When the gate is "closed", the video filters, peak detectors, and digitizer are given a signal at the bottom of the display.

The gate function requires that a gate trigger signal be connected to the **GATE TRIG/EXT TRIG IN (TTL)** input on the rear panel. When the gate function is on, the state of the gate appears at the **GATE/HI SWP OUT (TTL)** rear panel connector. A TTL high output indicates that the gate is open. The gate out signal is only valid while the analyzer is sweeping. Between sweeps, the gate out signal is invalid. You can adjust the gate delay and gate length using an oscilloscope to view the gate out signal. The analyzer sweep time should be set to a large value (50 sec) during the adjustment so that the gate signal is valid most of the time. When the adjustment is done you can set the analyzer back to the desired sweep time, or set it back to **Auto Couple**.

Key Access: **Sweep, Gate**

NOTE

Trig Delay (On) and **Gate (On)** cannot be active at the same time. If **Trig Delay (On)** has been previously selected, it will be reset to **Trig Delay (Off)** when **Gate (On)** is selected. Conversely, if **Gate (On)** has been previously selected, it will be reset to

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Gate (Off) when **Trig Delay (On)** is selected.

NOTE If **Gate (On)** is selected without an external trigger signal present, operating other functions, such as: tracking, frequency count, or preselector centering, may cause the analyzer to stop functioning until it is powered on again.

Gate Control

Edge Level Allows you to select between **Edge** and **Level** triggering of the gate. **Gate Control (Edge)** opens the gate in response to an edge trigger on the trigger input after a delay set in **Gate Delay**. The gate stays open for the selected **Gate Length**. When **Gate Control (Level)** is selected, the gate is open as long as the trigger input is true, as defined under the **Level Gate** key.

Key Access: **Sweep**, **Gate**

Edge Gate Accesses menu keys that allow you to set up edge triggering.

Key Access: **Sweep**, **Gate**

Slope Pos Neg Sets the polarity for edge triggering of the gate. When **Slope (Pos)** is pressed, a positive-going edge will trigger the opening of the gate, after the delay set with the **Gate Delay** key. When **Slope (Neg)** is pressed, a negative-going edge will trigger the opening of the gate after the set delay.

Key Access: **Sweep**, **Gate**, **Edge Gate**

Gate Delay Controls the length of time from the trigger until the gate is turned on.

Key Access: **Sweep**, **Gate**, **Edge Gate**

Gate Length Controls the length of time that the gate is on when using edge triggering to control the gate.

Key Access: **Sweep**, **Gate**, **Edge Gate**

Level Gate

High Low Sets up level polarity that will open the gate. Requires Option 1D6.

Level Gate (High) Selects a high TTL level to open the gate. **Level Gate (Low)** selects a low TTL level to open the gate.

Key Access: **Sweep**, **Gate**

Points Allows you to set the number of points per sweep, from 101 to 8192 in non-zero span and 2 to 8192 in zero span (firmware revision A.05.00 and greater). Use the knob, step keys, or numeric keypad to set this value. When the sweep time is limited by the Analog to Digital Converter (ADC) sample rate, the sweep time

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changes with the number of points selected. The greater the number of points, the longer the sweep time becomes. If **Preset** is pressed (and **Preset Type** is set to **Factory**), or the analyzer power is cycled, the number of points per sweep will default to 401. The current value of points is displayed next to the sweep time.

When **FREQUENCY**, **Scale Type (Log)** is selected, the desired number of sweep points may not be possible. Refer to "Scale Type Log Lin" on page 98 for more information.

Changing the number of points has several effects on the analyzer. Since markers are read at the point location, the marker reading may change. Press **Peak Search**, again for greater accuracy in the marker reading. All trace data for the current window is cleared. If in continuous sweep mode, (**Sweep**, **Sweep (Cont)**), a new sweep begins immediately. If average is on (**BW/Avg**, **Average (On)**), the averaging starts over with a count of 0. With firmware revisions prior to A.08.00, if Limit Lines are on (**Display**, **Limits**, **Modify**, **Limit 1 or 2 (On)**), they are turned off.

Key Access: **Sweep**

NOTE

By selecting a number of sweep points greater than 401, you are optimizing frequency resolution and accuracy while accepting a reduced measurement speed. In addition to sweep points, the span, resolution bandwidth, video bandwidth, average detection and center frequency will also affect measurement speed.

This function is not available when signal identification is on **(Input/Output, Input Mixer, Signal Ident (On)).**

When zone span is on (**Span**, **Zone**. **Zone (On)**), each window has its own value for points.

This feature is not available in the ESA-L Series. The number of points per sweep for these models is always set to 401.

Segmented

Accesses the segmented sweep function and its editor.

Segmented sweep is a method in which you can select multiple frequency bands (a maximum of 32), specify their parameters individually, and display them as a single trace. This function of the analyzer results in faster measurements and provides greater detail and resolution in particular bands of interest. To set the parameters of individual segments, go to the editor (**Sweep, Segmented, Modify, Edit**) and refer to the parameter key descriptions below. For measurement examples of the segmented sweep function, refer to the *Agilent ESA Spectrum Analyzers Measurement Guide*.

Key Access: **Sweep**

NOTE

This feature is only available on ESA-E series analyzers (E4401B, E4402B, E4404B, E4405B, E4407B) with firmware revision ≥ A.05.00.

Segmented On Off

Turning segmented sweep on (**Sweep**, **Segmented**, **Segmented (On)**) displays each

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sweep segment from left to right in order of increasing start frequency. When segments have the same start frequency, the segments are displayed in order of increasing stop frequency. Overlapping segments are acceptable. (Note however; the reference marker for a marker delta will be displayed in the first segment).

Segments are demarcated by vertical lines. The width of a given segment is determined by the ratio of the number of sweep in the segment to the number of sweep in the total trace. For example, if there are five segments with 101 sweep each (505 total), each segment occupies 20% of trace. If you increase the number of in one of the segments to 404 (808 total), that segment will occupy half of the trace; the other four segments, 12.5% each. You can define up to 32 segments with a total maximum number of sweep equal to 8192.

NOTE **Frequency**, **Scale Type (Log)** is not available when **Segmented (On)** is selected.

Key Access: **Sweep**, **Segmented**

Modify

Accesses the segmented sweep editor described below.

Key Access: **Sweep**, **Segmented**

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Segmented Sweep Editor

When the editor is entered (**Sweep, Segmented, Modify, Edit**), the segmented sweep mode is turned on, and a dual-display appears. The upper window shows the trace, displayed as described above. The lower window shows the editor data in tabular form: one segment per row with segment number and parameter values occupying the seven columns. The paramenters that can be set are:

- Center Freq
- Span
- Resolution BW
- Video BW
- Sweep Time (Zero Span only)

The trace is updated after each segment has a complete row of data entered. Although thirty-two segments are possible, only 8 rows of data are shown in the table at a time.

Use the tab keys or softkey menu to navigate the editor. When defining a new segment, you may use the numeric keypad to set values. Pressing **Enter** places the value in the table and highlights the next parameter available for modification.

NOTE The order of the segments may change when you enter center frequency or span because the sequence is based upon increasing start frequency.

Various parameters are coupled to ensure accurate measurements. You will not be able to enter a value that would result in a measurement that is uncalibrated.

Amplitude parameters are common to all segments and are defined via the amplitude softkey menu. Refer to “AMPLITUDE Y Scale” on page 38 for more information.

The data in the segmented sweep table is retained through a power cycle. Table values can only be deleted by the **Delete** keys described below.

To exit the editor press any key except **Print**, **Help,** and the viewing angle adjustments.

NOTE Exiting the editor does not turn off segmented sweep. **Segmented (Off)** must be selected.

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Interaction with Other Analyzer Functions

Certain conditions prevent segmented sweep from being activated, while others cause this mode to be turned off. For analyzers with Option AYZ, the mixer frequency range (**Input**, **Input Mixer (Ext)**, **Ext Mix Band**) must be set to include the frequencies of interest in the segmented sweep table. If the mixer range is not the same, segmented sweep will not turn on. If the mixer range is changed, segmented sweep will be turned off.

Segmented sweep is not available when the following analyzer functions are turned on: Demod, Signal ID, and Signal Track. In addition, keys which access these functions are grayed out if segmented sweep is on. This is also true for the following functions: Mkr→CF, Mkr→CF Step, Mkr→CF Start, Mkr→CF Stop, MkrΔ→Span, Span Zoom, Zone Span, and Zero Span.

Confining marker pairs (marker delta, delta pair, and span pair) to one segment facilitates interpretation of marker readings. However, marker pairs can provide useful information across segments. Amplitude readings are straightforward because the y-axis is consistent over all segments. Frequency or time readings require consideration of differences in sweep time, number of, and span when interpreting measurements across segments.

Marker delta functions differently depending upon the type of segment in which it is activated. If you turn on marker delta in a segment set to 0 Hz span, it remains in that segment and provides amplitude and time difference measurements. If you initiate a marker delta in a non-zero span segment, it will function across segments and continue to display frequency and amplitude information.

Delta pair and span pair function similarly to marker delta in segmented sweep with some characteristics which need to be noted. When a delta or span pair is initiated in segmented sweep, the analyzer defaults to the frequency domain. If you wish to make time measurements in a zero-span segment, the domain must be set to time (**Marker**, **More**, **Readout**, **Time**). The delta or span pair can traverse all segments without regard to the type of segment in which they were initiated.

NOTE Turn markers off (**Marker**, **Off**) when entering or exiting segmented sweep (**Segmented**, **Segmented (Off)**).

Performing a factory preset will turn segmented sweep off. This is also true if you select full span or last span.

Functions which are parameters of segmented sweep are not available when accessed by pressing the following front-panel keys: **Auto Couple**, **BW/Avg** (**Resolution BW** and **Video BW**), **Frequency** (the entire softkey menu), **Span** (see above), and **Sweep** (**Sweep Time** and **Points**).

When the sweep trigger is set to any of the trigger selections other than free run, no sweep occurs until the trigger condition is met. Once the trigger occurs, all segments are swept, completing the entire trace.

NOTE For spectrum analyzers with Option 1DN or Option 1DQ, the tracking generator

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must be turned on (**Source**, **Amplitude (On)**) before you set up the segmented sweep table.

The on/off state of the segmented sweep mode and the segmented sweep table can be saved as a "state" type file (see "Save" on page 130) or as part of the power on/preset function (see "Power On/Preset" on page 152).

NOTE When loading a "state" type file, segmented sweep will not turn on if any of the parameters in the file contain optional instrument settings not currently loaded on the analyzer or frequency settings outside the current range of the analyzer.

Edit Accesses the segmented sweep editor, where a maximum of thirty-two segments can be defined by the segment number and the six parameters described below. Use the data control keys described in the *Agilent ESA Spectrum Analyzer Getting Started Guide* to enter the setting as each parameter is highlighted. Refer to the "Editor" section above for more information.

Key Access: **Sweep**, **Segmented**, **Modify**

Segment Allows you to select a previously defined segment or the next segment for modification. Use the numeric keypad to select a specific segment or press the **Tab** keys to access adjacent segments.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Center Freq Allows you to specify the center frequency for a particular segment using the data control keys. For more information on this function, refer to "Center Freq" on page 96.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Span Allows you to select a frequency range symmetrically about the center frequency for the current segment using the data control keys.

NOTE The order of the segments may change when you enter center frequency or span because the sequence is based upon increasing start frequency. Refer to the "Displaying the Trace" section above, for clarification.

Zero span is available for any or all segments. It must be set by pressing **Span**, **0**, **Hz**. For more information on this function, refer to "Zero Span" on page 136.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Res BW Allows you to select the resolution bandwidth to a value between 1 kHz and 5 MHz for the current segment using the data control keys.

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For more information on this function, refer to "BW/Avg" on page 60.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Video BW Allows you to set the video bandwidth for the current segment to a value between 30 Hz and 3 MHz. For more information, refer to "Video BW Auto Man" on page 60.

Key Access: **Sweep, Segmented, Modify**, **Edit**

Points Allows you to set the number of points for the current segment. The minimum number of points in a zero span segment is 2; in a non-zero-span segment, 101. The maximum number of points in the total sweep is 8192. If you exceed the number of points available in one segment, the message: `Too much data; total sweep points limited` will be displayed in the status line (yellow on color displays).

Key Access: **Sweep, Segmented, Modify**, **Edit**

Sweep Time Allows you to set the sweep time for the current zero span segment. For a non-zero span segment, the sweep time is auto-coupled to Span, Resolution Bandwidth, and Video Bandwidth and cannot be manually defined. The minimum sweep time is displayed. Refer to "Sweep Time Auto Man" on page 142 for more information.

Key Access: **Sweep, Segmented, Modify**, **Edit, More**

NOTE The parameters for each segment are limited to ensure the occurrence of only calibrated measurements.

Delete Segment Deletes the highlighted segment.

Key Access: **Sweep, Segmented, Modify**, **Edit, More**

Delete Segment Initiates the deletion of all segments. After pressing this key once, the message: `If you are sure, press key again to delete` will be displayed. Pressing **Delete** again will complete the process.

Key Access: **Sweep, Segmented, Modify**

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System (Local)

Accesses the System menu keys. Pressing **System (Local)** after the analyzer has been placed in the remote mode, places the analyzer in the local mode and enables front-panel control. During remote operation, R appears in the upper-right corner of the screen. R, T, L, or S may appear during remote operation, indicating talk, listen, or service request. Pressing the **System (Local)** key removes the R symbol in the upper-right corner.

Show Errors

Accesses a display of the last 30 errors reported. The most recent error will appear at the top of the list. The first error listed will be the first error removed if the error list is longer than 30 entries. If the same error message occurs several times the error message will be incremented rather than added to the list as a new error message.

The date and time identify the first time and the last time (if there is more than one of the same type of error) an error occurred. The number of identical errors is shown, and the error number is also shown with firmware revision A.08.00 and later.

Key Access: **System**

Prev Page

Allows you to access the previous page of error messages. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **Show Errors**

Next Page

Allows you to access the next page of error messages. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **Show Errors**

Verbose SCPI On Off

The information in the Error History Screen is formatted to fit the screen size. Additional information is available via the **SYSTem:ERRor?** command. It indicates which SCPI command was executing when the error occurred and what about that command was unacceptable.

Example: First set **SYST:ERR:VERBOSE ON**

If the command **SENSe:FREQuently:CENTer 942.6MHz** is sent, then sending **SYST:ERR?** returns:

-113, "Undefined header;SENSe:FREQuently:<Err>CENTer 942.6MHz $<NL>"

Key Access: **System**, **Show Errors**

Clear Error Queue

Clears the error queue in the **Show Errors** display.

Key Access: **System**, **Show Errors**

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Power On/Preset Accesses the following menu keys.

Key Access: **System**

Power On Last Preset Determines the state of the analyzer when the analyzer is powered on. If the Power On function is set to **Preset**, the state of the analyzer is the same as it is after **Preset** is pressed, when the analyzer is powered on. If the Power On function is set to **Last**, then the state that the analyzer was in when it was powered off is recalled.

The setting (Last or Preset) of the Power On function is not changed by pressing **Preset**. Use the **Power On/Preset** menu key function to change the setting of the analyzer state that is recalled at power on. Limit lines are not recalled when the analyzer is powered on. Refer to "Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**

Preset Type Allows you to select User, Mode, or Factory preset.

Key Access: **System**, **Power On/Preset**

User Pressing **Preset (User)** sets the analyzer to the settings defined by the **Save User Preset** key. Refer to "Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**, **Preset Type**

Mode Selects the mode preset type to be the instrument state that will be restored when you do a preset. A mode preset does not change the mode and it only resets the settings of the current mode to their factory defaults.

Key Access: **System**, **Power On/Preset, Preset Type**

Factory Pressing **Factory** presets the analyzer to the configuration originally set at the factory. Refer to the "Preset" key description for the default factory- configuration settings.

Key Access: **System**, **Power On/Preset, Preset Type**

Key Access: **System**, **Power On/Preset**, **Preset Type**

Save User Preset Saves the active state of the analyzer into the User Preset register for recall on **Preset** if **Preset (User)** is selected. Refer to

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"Preset" in this chapter for more information.

Key Access: **System**, **Power On/Preset**

Time/Date

Accesses the following **Time/Date** menu keys used to set and display the real-time clock:

Key Access: **System**

Time/Date

On Off

Turns the display of the real-time clock on or off.

Key Access: **System**, **Time/Date**

Date Format

MDY DMY

Changes the display of the date from a month-day-year format to a day-month-year format.

Key Access: **System**, **Time/Date**

Set Time

Allows you to set the time of the real-time clock. Enter the time in 24 hour HHMMSS format, using the numeric keypad and pressing **Enter**. Valid hour (HH) values are from 00 to 23. Valid minute (MM) and second (SS) values are from 00 to 59.

Key Access: **System**, **Time/Date**

Set Date

Allows you to set the date of the real-time clock. Enter the date in the YYYYMMDD format using the numeric keypad and press **Enter**. Valid year (YYYY) values are 0000 through 9999. Valid month (MM) values are from 01 to 12, and valid day values are from 01 to 31.

Key Access: **System**, **Time/Date**

Alignments

Accesses the following **Alignments** menu keys which align the internal circuitry of the analyzer, load default values for the alignment system, and adjust the 10 MHz reference.

Key Access: **System**

Auto Align

Accesses the **Auto Align** menu keys.

All

Turns on the automatic alignment of all measurement systems. When **Auto Align**, **All** is selected, "**AA**" appears along the left edge of the display.

Key Access: **System**, **Alignments**

All but RF

Turns on the automatic alignment of all measurement systems except the RF section. (Eliminating automatic alignment of the RF prevents changes in the input impedance between sweeps, which could cause input device instability.) When **Auto Align**, **All but**

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RF is selected, "**AB**" appears along the left edge of the display.

Key Access: **System**, **Alignments**

Off Turns off automatic alignment.

Key Access: **System**, **Alignments**

NOTE It is normal to hear clicking sounds when the Auto Alignment function is On. During retrace, a small portion of the analyzer circuitry is realigned. Some of the switching of the analyzer circuitry is done using relays. It is the rapid switching of these relays during retrace that causes the clicking sounds. To eliminate the clicking sounds, turn the auto alignment off by pressing **System**, **Alignments**, **Auto Align**, **Off**. When this is done, the **Align Now**, **All** function should be performed periodically. Refer to the appropriate "Specifications and Characteristics" chapter of your Specifications Guide for more information on how often to perform **Align Now**, **All** when the auto alignment is off

Align Now Accesses the **Align Now** menu keys and immediately executes an alignment cycle of the selected system(s). Menu key selections include:

Key Access: **System**, **Alignments**

All Initiates the alignment of all systems. Except the Option 1DN Tracking Generator for models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B.

Key Access: **System**, **Alignments, Align Now**

RF (Ext Cable) Initiates the alignment of the RF system with a cable connected from AMPTD REF OUT to INPUT 50 Ω. Models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B.

Key Access: **System**, **Alignments, Align Now**

RF Initiates the alignment of the RF system. Models E4401B and E4411B only. This Alignment uses an Internal Signal Source.

Key Access: **System**, **Alignments, Align Now**

TG (Ext Cable) Initiates the alignment of the tracking generator only when the Option 1DN is installed in Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. You must connect a cable from RF OUT 50 Ω to INPUT 50 Ω

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Key Access: **System**, **Alignments, Align Now**

FM Demod Initiates an alignment of the FM demodulation system only when Option BAA or Option 106 is installed.

Key Access: **System**, **Alignments, Align Now**

After a five minute warm-up, **Align Now**, **All** (with a cable connected from AMPTD REF OUT to INPUT 50 Ω) should be performed on Agilent E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. Refer to your analyzer's appropriate Specifications Guide for details on using **Align Now** when **Auto Align** is **Off**.

Freq Correct
On Off Controls use of some of the correction factors. When On is underlined, frequency correction factors are used. When Off is underlined, frequency correction factors are not used, and `Freq Corr Off` appears on the display. Turning the correction factors off degrades frequency accuracy.

Key Access: **System**, **Alignments**

NOTE Frequency correction factors must be on for the analyzer to meet its specified performance.

Timebase Accesses the **Fine** and **Coarse** Timebase menu keys, which allow control of the 10 MHz time base frequency. This function is used to verify the settability of the 10 MHz reference and to adjust for changed operating conditions, such as temperature. Pressing **Load Defaults** or cycling power, resets the time base to its original value.

Key Access: **System**, **Alignments**

Load Defaults Loads the default values for the alignment system, turns on the frequency corrections, and resets the time base to the factory values. **Align Now, All**, will automatically execute three times after pressing **Load Defaults**.

Key Access: **System**, **Alignments**

Remote Port *With Option A4H (GPIB and Parallel) only*. Allows the GPIB address to be entered. The default address is 18.

With Option 1AX (RS-232 and Parallel) only. Allows the baud rate to be set. The available baud rate values are as follows: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. The default baud rate is 9600.

Key Access: **System**

Show System Displays the number and description of the options installed in your analyzer. It also displays the instrument model number, product number, serial number,

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firmware revision number, Host ID (for licensing), bootrom revision, and amount of RAM and ROM.

Key Access: **System**, **More**

Prev Page Allows you to access the previous page of show system. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **More**, **Show System**

Next Page Allows you to access the next page of show system. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **More**, **Show System**

Show Hdwr Gives detailed information about the hardware installed on your analyzer.

Key Access: **System**, **More**

Prev Page Allows you to access the previous page of show hardware. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **More**, **Show Hdwr**

Next Page Allows you to access the next page of show hardware. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **More**, **Show Hdwr**

Color Palette Accesses the **Color Palette** menu keys. These keys are only available with analyzers having a color display.

Key Access: **System**, **More**

Default Sets all the display screen attributes to the factory defined colors.

Key Access: **System**, **More**, **Color Palette**

Vision Impair 1 and **Vision Impair 2** The special colors built into the **Vision Impair 1** and **Vision Impair 2** keys accommodate most color-deficient vision problems.

Key Access: **System**, **More**, **Color Palette**

Optical Filter Accommodates the use of protective goggles while viewing lasers.

Key Access: **System**, **More**, **Color Palette**

Monochrome Sets the display screen to green monochrome. The monochrome display uses different shades of green for each green value. This is especially useful for driving external monochrome monitors.

Key Access: **System**, **More**, **Color Palette**

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Diagnostics Accesses the **Front Panel Test** menu key.

Key Access: **System**, **More**

Front Panel Test Allows you to verify the functionality of each front-panel key (except **Preset**). The number next to each key name increments once each time the key is pressed. Rotating the knobs causes the number of pulses to be counted. Press **ESC** to exit.

Key Access: **System**, **More**, **Diagnostics**

Restore Sys Defaults Resets the "persistent" state variables to their defaults. These are values, such as the GPIB address, that are unaffected by a power cycle or a preset (when **Preset Type** is set to **Factory**.)

Key Access: **System**, **More**

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Table 2-3 System Default Settings

Feature	Default Setting
Color Printing	On
Custom Printer, Color Capability	No
Custom Printer, Language	PCL3
Date Format	MDY
Display Viewing Angle	4
External Amplifier Gain	0 dBm
GPIB Address	18
Input Impedance	50 (Ohm)[1]
Instrument Color Palette	Default palette
Manual Tracking Adjustment	2048
Page Size	Letter
Power On Last/Preset	Preset
Preset Factory/User	Mode
Print Format	Print screen mode
Print Orientation	Portrait
Printer Selection	Auto
Prints/ Page	1
RS-232 Baud Rate	9600
RS-232 DTR Control	On (hardware pacing)
RS-232 Receive Pacing	None (data pacing)
RS-232 RTS Control	IBFULL (hardware pacing)
RS-232 Transmit Pacing	None (data pacing)
Speaker Volume	0
Time Date Display	On
Verbose SCPI	Off

1. This value may be 75 ohms, depending upon the analyzer hardware configuration.

Licensing

Accesses the security system to enable licensing for individual options. For information on how to use this system, see the installation information for individual options in the measurement personalities' user's guides.

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NOTE Not all options can be enabled using this system and there is no way to turn *off* an option through this system. Once an option has been licensed for a given analyzer, it cannot be transferred to a different analyzer.

Key Access: **System**, **More, More**

Option Accesses the Alpha Editor allowing you to enter a three character option number. To terminate the entry, press **Enter** or **Return**. An external keyboard may also be used for this entry. The option number will appear on the second line of the **Option** key. Key

Access: **System**, **More**, **Licensing**

License Key Accesses the Alpha Editor allowing you to enter the license key number. To terminate the entry, press **Enter** or **Return**. An external keyboard may also be used for this entry. The license key number will appear on the second line of the **License Key** menu key.

Key Access: **System**, **More**, **Licensing**

Activate License Allows you to activate the option that you previously entered with **License Key**. If your entry was correct, the option will be enabled and the message: `Option activated` will appear in the status line of your display. The option number and license key number will also be cleared from the **License Key** and **Option** key.

If your entry was incorrect, the error message: **`License key invalid`** will appear in the status line of your display. The option number and license key number can be edited until they are correct.

Key Access: **System**, **More**, **Licensing**

NOTE It is possible to enable an option for which the analyzer is not yet configured. Therefore, the message `Option activated` does not mean that the option will immediately function. For a display of options that are enabled and for which the analyzer is properly configured, press **System**, **More**, **Show System**.

Delete License Pressing this key deletes the license key that is associated with the currently selected Option. This means the corresponding option will be disabled. If this is a software option, it will be disabled, but the application will not be deleted from instrument memory. (The option and license key must be entered to perform a **Delete License**.

Key Access: **System**, **More**, **Licensing**

Show License Shows you the license information screen which lists all the existing license keys along with their related option code and a

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brief description of the option. Pressing any front panel key exits the license information screen.

- **Prev Page** - Views a previous page of license information. It is grayed out if you are on the first page or only one page exists.
- **Next Page** - Views the next page of license information. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **More**, **Licensing**

Personalities

Accesses a display listing the personalities that are currently installed in the analyzer. Information about the personalities are under the column headings **Opt** (option number), **Name** (option name), **Version** (personality version), **Licensed** (whether or not the personality is licensed), and **Size** (personality memory). At the bottom of the display is a line showing the available memory for installing personalities.

Key Access: **System**, **More**, **More**

NOTE

Some files are shared between personalities. If shared files are installed, a personality may require less room than is indicated on the display. The **Uninstall** key will not delete any shared file unless the personality being deleted is the last personality to use the shared file.

Prev Page

Allows you to view a previous page of installed personalities. It is grayed out if you are on the first page or only one page exists.

Key Access: **System**, **More**, **More**, **Personalities**

Next Page

Allows you to view the next page of installed personalities. It is grayed out if you are on the last page or only one page exists.

Key Access: **System**, **More**, **More**, **Personalities**

Install

Allows you to install personalities in the analyzer. For more information on this key, see the documentation that accompanies the personalities software.

Key Access: **System**, **More**, **More**, **Personalities**

Uninstall

Allows you to uninstall a personality. Highlight the appropriate personality and press **Uninstall**, **Uninstall Now**. You will be prompted with the displayed message `If you are sure you want to uninstall, press Uninstall Now again`.

Some personalities may not be deleted. If the attempt is made to do so, the message `Can't uninstall this program` will appear on the display.

Key Access: **System**, **More**, **More**, **Personalities**

Service

Accesses the **Service** menu keys. You must have a password to access this menu.

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For information, refer to the troubleshooting chapter in the your Service Guide.

Key Access: **System**, **More**, **More**

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Tab Keys

The Tab keys are located below the display and are used to move between fields in the tables and forms.

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Trace/View

Accesses the trace keys that allow you to store and manipulate trace information. Each trace is comprised of a series of data points in which amplitude information is stored. The analyzer updates the information for any active trace with each sweep.

NOTE If you have selected **Channel Power**, **ACP**, **Harmonic Distortion**, **Burst Power**, **Power Stat CCDF**, or **Spectrum Emission Mask** in the **MEASURE** menu, refer to the one-button measurement information in Volume 2.

Trace 1 2 3 Selects the menu keys used for trace 1, trace 2, or trace 3 functions. Press **Trace 1 2 3** until the number of the desired trace is underlined.

Key Access: **Trace/View**

CAUTION When using normalization, the mode of traces 2 and 3 should not be changed.

Clear Write Erases any data previously stored in the selected trace and continuously displays any signals during the sweep of the analyzer. This function is activated for trace 1 at power-on and by pressing **Preset**.

Key Access: **Trace/View**

Max Hold Maintains the maximum level for each trace point of the selected trace (1, 2 or 3), and updates each trace point if a new maximum level is detected in successive sweeps.

NOTE If the **Det/Demod**, **Detector** (Auto) is selected, the detection type may change with trace mode. See Figure 2-1 on page 55 for more detailed information.

Key Access: **Trace/View**

NOTE Changing the vertical scale (**Amplitude**, **Scale Type**, Log or Lin), pressing **Restart**, turning averaging on (**BW/Avg**, **Average (On)**), or switching window in Zone Span (**Span**, **Zone**) restarts the held trace.

Min Hold Maintains the minimum level for each trace point of the selected trace (1, 2 or 3), and updates each trace point if a new minimum level is detected in successive sweeps.

Key Access: **Trace/View**

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NOTE If the detector is Auto Coupled when you select **Min Hold**, the detector may change, dependent on the other active trace functions. Manually select a detector if a specific detector is required before selecting **Min Hold**. Refer to Figure 2-1, "Detector (Auto) Selection Flowchart," on page 55.

NOTE Changing the vertical scale (**Amplitude**, **Scale Type**, Log or Lin), pressing **Restart**, turning averaging on (**BW/Avg**, **Average (On)**), or switching window in Zone Span (**Span**, **Zone**) restarts the held trace.

View Holds and displays the amplitude data of the selected trace. The trace register is not updated as the analyzer sweeps. If a trace is deactivated by pressing **Blank,** the stored trace data can be retrieved by pressing **View**.

Key Access: **Trace/View**

Blank Stores the amplitude data for the selected trace, and removes it from the display. The selected trace register will not be updated as the analyzer sweeps. This function is activated for traces 2 and 3 at power-on and by pressing **Preset** (when **Preset Type** is set to **Factory**.)

Key Access: **Trace/View**

Operations Accesses the following **Operations** menu keys:

Key Access: **Trace/View**, **More**

1↔2 Exchanges the contents of the trace 1 register with the trace 2 register and puts trace 1 and 2 in view mode.

Key Access: **Trace/View**, **More**, **Operations**

2 – DL → 2 Subtracts the display line from trace 2 and places the result in trace 2 and puts trace 2 in view mode. The **2 – DL → 2** function is a math operation.

Key Access: **Trace/View**, **More**, **Operations**

2 ↔ 3 Exchanges the contents of trace 2 with trace 3 and puts trace 2 and 3 in view mode.

Key Access: **Trace/View**, **More**, **Operations**

1 → 3 Copies trace 1 into trace 3 and puts trace 3 in view mode.

Key Access: **Trace/View**, **More**, **Operations**

2 → 3 Copies trace 2 into trace 3 and puts trace 3 in view mode.

Key Access: **Trace/View**, **More**, **Operations**

Normalize Accesses the following **Normalize** menu keys:

Key Access: **Trace/View**, **More**

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Store Ref (1→ 3)

Copies trace 1 into trace 3. **Store Ref (1→ 3)** must be pressed before pressing **Normalize (On)**. If **Normalize (On)** is pressed before **Store Ref (1→ 3)**, the error message: `Store reference trace before turning on Normalize` is displayed in the status line, however Normalize has been activated.

Key Access: **View/Trac**, **More**, **Normalize**

Normalize On Off

Normalize (On) Activates the normalize function. On each sweep, the normalized trace (Trace 3) is subtracted from Trace 1 and the result is added to the normalized reference level. The display shows the result of the following calculation:

Trace 1 – Normalized Trace + Normalized Reference Level

The trace data is normalized with respect to the normalized reference level, even if the value of the normalized reference level is changed. This function remains in effect on all subsequent sweeps until it is turned off.

NOTE Segmented sweep is not available when **Normalize (On)** is selected.

CAUTION Trace 1 should be in clear write mode prior to setting normalize to on.

The normalize function is most useful for applying correction data to a trace while making a stimulus response measurement with a tracking generator. For example, connect the cables and a thru line, in place of the device to be measured, between the tracking generator and the analyzer input. Notice that the frequency response is not perfectly flat, showing the response of the cables, as well as the flatness of both the tracking generator and the analyzer.

Now press **Store Ref (1→ 3)**, **Normalize On**. Notice that the displayed trace is now flat, or normalized. The position of the normalized trace can now be moved to a different position on the display by changing the normalized reference position. This may be useful if the device to be tested has positive gain, such as an amplifier. Now replace the thru line with the device under test, and an accurate measurement of the gain or loss can be made.

Key Access: **Trace/View**, **More**, **Normalize**

Norm Ref Lvl Sets the level (in dB) of the normalized reference.

Key Access: **Trace/View**, **More**, **Normalize**

Norm Ref Posn Offsets the displayed trace without affecting the instrument gain or attenuation settings. This allows the displayed trace to be

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moved without decreasing measurement accuracy. The normalized reference position is indicated with a (>) character on the left side of the display and a (<) character on the right side of the display.

Key Access: **Trace/View**, **More**, **Normalize**

Ref Trace View Blank

Allows you to view or blank the reference trace on the display.

Key Access: **Trace/View**, **More**, **Normalize**

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Trig

Accesses the menu of keys that allow you to select the sweep mode and trigger mode of the analyzer.

Free Run New sweep starts as soon as possible after the current sweep ends.

Key Access: **Trig**

Video Activates the trigger condition that allows the next sweep to start if the detected RF envelope voltage rises to a level set by the video trigger level. When **Video** is pressed, a line appears on the display. The analyzer triggers when the input signal exceeds the trigger level at the left edge of the display. You can change the trigger level using the step keys, the knob, or the numeric keypad

Key Access: **Trig**

NOTE This function is not available when the Resolution Bandwidth is less than 1 kHz. If a Resolution Bandwidth less than 1 kHz is selected while in Video Trigger mode, the Trigger mode changes to Free Run.

Line Activates the trigger condition that allows the next sweep to be synchronized with the next cycle of the line voltage.

Key Access: **Trig**

NOTE Line trigger is not available when operating from a dc power source.

External Pos Neg Activates the trigger condition that allows the next sweep to start when the external voltage (connected to **GATE TRIG/EXT TRIG IN** on the rear panel) passes through approximately 1.5 volts. The external trigger signal must be a 0 V to +5 V TTL signal. This function also controls the trigger polarity (for positive or negative-going signals).

Key Access: **Trig**

TV *Option B7B (TV Trigger and Picture on Screen) only*. Activates the trigger condition that allows the next sweep to be synchronized with the next occurrence of the synchronizing pulse of a selected TV line.

Line number range is dependent on the settings of the **Standard** and **Field** menus within the **TV Trig Setup** menu. When the line number is incremented beyond the upper limit, the value will change to the lower limit and continue incrementing from there. When the line number is decremented below the lower limit, the value will change to the upper limit and continue decrementing from there.

Key Access: **Trig**

RF Burst *Option B7E (RF Communications Hardware) only.* Allows the analyzer to be

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triggered by an RF burst envelope signal. The trigger level can be set to either a level relative to the peak of the burst or to an absolute value.

Key Access: **Trig**

Trig Delay On Off

Allows you to set and turn on or off a delay, during which the analyzer will wait to begin a sweep after receiving an external trigger signal. This function is not available when **Gate** is on. **Trig Delay** is active when **External** is selected.

Key Access: **Trig**, **More**

NOTE This function is not available in Free Run or Video Trigger modes.

Trig Offset On Off

Allows you to set and turn on or off an offset value from the trigger point of the sweep at which to begin storing data in the trace of the analyzer. The offset is specified as a function of time, and permits positive (pre trigger) and negative (post trigger) values to be specified.

Key Access: **Trig**, **More**

NOTE This function is only available when in Zero Span. (It is grayed out when in swept span.) If this key is pressed in swept spans, the error message: `Trigger Offset unavailable in swept spans` is displayed in the status line. The value and state of Trigger Offset is remembered if Zero Span is exited and restored when Zero Span is reselected.

NOTE This function is only available with Resolution Bandwidths of 1 kHz or greater. If this key is pressed when the Resolution Bandwidths is less than 1 kHz, the error message: `Trigger Offset unavailable in bandwidths < 1 kHz` is displayed in the status line. While Trigger Offset is on, it is not possible for the instrument to be set to a Resolution Bandwidth less than 1 kHz. Any attempt to do so will cause the error message: `Bandwidths <1 kHz unavailable with Trigger Offset on` to be displayed in the status line.

TV Trig Setup

Option B7B (TV Trigger and Picture on Screen) only. Accesses the setup functions for TV Trigger.

Key Access: **Trig**

Field

Allows you to determine how the fields of the TV picture signal will be affected by the trigger system. One complete TV image consists of one frame of 525 or 625 horizontal lines depending on the TV standard being used. Each frame is composed of two fields of interlacing lines, each consisting of 262 1/2 lines (or 312 1/2 lines). The fields are called Field One and Field Two. Field One is viewed as having 263 lines (or 313 lines) and Field Two is viewed as having 262 lines (or 312 lines).

For the 525 line NTSC video standard, we refer to TV lines as follows (these are the Field Modes):

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Entire Frame, lines 1 to 525
Field One, lines 1 to 263
Field Two, lines 1 to 262 (note that this really refers to "actual" lines 264 to 525)

For the 625 line PAL and SECAM video standards, we refer to TV lines as follows:

Entire Frame, lines 1 to 625
Field One, lines 1 to 313
Field Two, lines 314 to 625

As the Field is changed, the appropriate value for Line is chosen to keep triggering on the same line as before, or if this is not possible, the corresponding line in the new Field. For example, suppose line 264 is selected while in the NTSC-M standard and the Entire Frame mode. This is the first line in Field Two. If Field Two is then selected, the Line number changes to Line 1, the same actual line in the TV signal. If Field One is then selected, the line number stays at 1, but now we are triggering in the first line in Field One. The only exception to this is if we are on the last line of Field One and change to Field Two. In this case, we go to the last line in Field Two.

Key Access: **Trig**, **More, TV Trig Setup**

Entire Frame Causes the selected line number to be viewed as an offset into the entire frame starting with line 1, the first line in Field One.

Key Access: **Trig**, **More**, **TV Trig Setup**, **Field**

Field One Causes the selected line number to be viewed as an offset into the first field starting with Line 1, the first line in Field One.

Key Access: **Trig**, **More, TV Trig Setup**, **Field**

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Field Two Causes the selected line number to be viewed as an offset into the second field. If Line 1 is selected, it is the 264th line of the frame (NTSC-M, NTSC-Japan, PAL-M) or the 314th line of the frame (PAL-B,D,G,H,I, PAL-N-Combin, SECAM-L).

Key Access: **Trig**, **More, TV Trig Setup**, **Field**

Sync Pos Neg Refers to the nature of the video waveform. Normal baseband video has a TV line sync pulse on the bottom of the waveform (more negative voltage). This is referred to as "negative" (**Sync Neg**). When the analyzer is used as a TV receiver to produce baseband video, the detected video is "upside down" with the sync pulse on the top of the waveform (this is true only for NTSC and PAL transmission standards, not for SECAM). This orientation is referred to as "positive" (**Sync Pos**).

Key Access: **Trig**, **More, TV Trig Setup**

Standard Accesses the Standard menu keys which allow you to select from the following TV standards: **NTSC-M**, **NTSC-Japan**, **PAL-M**, **PAL-B,D,G,H,I**, **PAL-N**, **PAL-N-Combin**, **SECAM-L**.

Key Access: **Trig**, **More, TV Trig Setup**

TV Source Allows you to select between the internal analyzer path (**SA**) or the EXT VIDEO IN connector on the rear panel (**Ext Video In**) as the source for the TV Trigger and TV Monitor functions. Note that this does not affect the signal viewed on the analyzer.

Key Access: **Trig**, **More, TV Trig Setup**

TV Monitor When **TV Monitor** is pressed, the selected Standard is used to determine the proper setup of the analyzer hardware for presentation of the TV picture. When the TV picture is active and on the display, pressing a key that normally accesses a menu, instead restores the original ESA graphical display with the selected menu enabled. The active function remains active and can be adjusted while the picture is displayed.

Key Access: **Trig**, **More, TV Trig Setup**

NOTE The color decoding circuitry is always enabled, even for weak and monochrome signals.

RF Burst Setup *Option B7E (RF Communications Hardware) only*. Accesses the setup functions for RF burst trigger. Refer to Volume 2 for more information about the Burst Power measurement.

Key Access: **Trig**, **More**

Trigger Level

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Abs Rel

Allows you to set the trigger level to a level relative to the peak of the burst or to an absolute value.

Key Access: **Trig**, **More**, **RF Burst Setup**

Frequency Selectivity On Off

Allows you to turn frequency selectivity on or off. With **Frequency Selectivity (Off)** selected, the trigger occurs on the signal prior to the resolution bandwidth filter. When **Frequency Selectivity (On)** is selected, the trigger occurs on the signal after the resolution bandwidth filter.

Key Access: **Trig**, **More**, **RF Burst Setup**

Narrow Pulse Discriminator On Off

Turns the narrow pulse discriminator on or off. For modulation formats that have undesirable envelope ripple, **Narrow Pulse Discriminator (On)** allows you to prevent re-triggering on the ripple.

Key Access: **Trig**, **More**, **RF Burst Setup**

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⇑ (UP) and ⇓ (DOWN) Arrow Keys

The ⇑ (UP) and ⇓ (DOWN) arrow keys can be used to adjust the analyzer parameters incrementally. The arrow keys are also used to select between files or points on a list. These keys are also called step keys.

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Viewing Angle

Controls the optimum viewing angle of the display. The viewing angle keys are located next to each other at the upper left-hand corner of the analyzer, bordering the display. These two keys allow you to adjust the intensity of the objects on the display so that it can be optimally viewed from different angles.

The **Viewing Angle** keys automatically repeat when they are held down.

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Zoom

Allows you to switch between the split-screen and full-sized display of the active window in zone span and other functions which support split-screen display modes. The active window is indicated by a solid green line surrounding the window.

If **Zoom** is pressed while in a non-split-screen display mode, it will activate the zone span mode. (See **Span**, **Zone**, and also **Next Window**.) If **Zoom** is pressed when zone markers are off, it will turn on zone markers and put the display in split-screen mode. (See **Span**, **Zone.**)

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3 Programming Fundamentals

The purpose of this chapter is to serve as a reminder of SCPI (Standard Commands for Programmable Instruments) fundamentals to those who have previous experience in programming SCPI. This chapter is not intended to teach you everything about the SCPI programming language. If you are using an optional programming compatibility modes, you should refer to the manual that came with the option.

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The SCPI Consortium or IEEE can provide detailed information on the subject of SCPI programming. Refer to IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation.* New York, NY, 1987, or to IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

Valid ESA Spectrum Analyzer SCPI commands are used for examples in this chapter. Topics included in this chapter are:

- "Creating Valid Commands"
- "Command Notation Syntax"
- "Special Characters in Commands"
- "Parameters in Commands"
- "Improving Measurement Speed"
- "Putting Multiple Commands on the Same Line"
- "Overview of GPIB (Option A4H)"
- "Overview of RS-232 (Option 1AX)"

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Creating Valid Commands

Commands are not case sensitive and there are often many different ways of writing a particular command. These are examples of valid commands for a given command syntax:

Command Syntax	Sample Valid Commands
`[:SENSe]:BANDwidth[:RESolution] <freq>`	The following sample commands are all identical. They will all cause the same result. • `:Sense:Band:Res 1700` • `:BANDWIDTH:RESOLUTION 1.7e3` • `:sens:band 1.7KHZ` • `:SENS:band 1.7E3Hz` • `:band 1.7kHz` • `:bandwidth:RES 1.7e3Hz`
`:CALCulate:MARKer[1]|2|3|4:Y?`	The last command below returns different results than the commands above it. The number 3 in the command causes this. See the command description for more information. • `:CALC:MARK:Y?` • `:calc:mark:y?` • `:CALC:MARK2:Y?`
`[:SENSe]:DETector[:FUNCtion] NEGative|POSitive|SAMPle`	• `DET:FUNC NEG` • `:Sense:Detector:Function Sample`
`:INITiate:CONTinuous OFF|ON|0|1`	The sample commands below are identical. • `:INIT:CONT ON` • `:init:continuous 1`

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Command Notation Syntax

A typical command is made up of key words set off by colons. The key words are followed by parameters that can be followed by optional units.

Example: **`:TRIGger:SEQuence:VIDeo:LEVel 2.5V`**

The instrument does not distinguish between upper and lower case letters. In the documentation, upper case letters indicate the short form of the key word. The upper and lower case letters, together, indicate the long form of the key word. Either form may be used in the command.

Example: **`:Trig:Seq:Vid:Lev 2.5V`** is the same as **`trigger:sequence:video:level 2.5V`**.

NOTE The command **`:TRIGG:Sequence:Video:Level 2.5V`** is not valid because **`:TRIGG`** is neither the long, nor the short form of the command.

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Special Characters in Commands

Special Character	Meaning	Example
|	A vertical stroke between **parameters** indicates alternative choices. The effect of the command is different depending on which parameter is selected. A vertical stroke between **key words** indicates identical effects exist for several key words. Only one of these key words is used at a time. The command functions the same for either key word.	Command: **[:SENSe]:DETector[:FUNCtion] NEGative|POSitive|SAMPle** The choices are neg, pos, and samp. **:SENSe:DETector:FUNCtion SAMPle** is one possible command choice. Command: **[:SENSe]:CHPower:BANDwidth|BWIDth:INTegration** Two identical commands are: **:SENSe:CHPower:BANDwidth:INTegration** **:SENSe:CHPower:BWIDth:INTegration**
[ ]	Key words in square brackets are optional when composing the command. These implied key words will be executed even if they are omitted.	Command: **[SENSe:]BANDwidth[:RESolution]:AUTO** The following commands are all valid and have identical effects: **:bandwidth:auto** **:bandwidth:resolution:auto** **:sense:bandwidth:auto**
< >	Angle brackets around a word, or words, indicates they are not to be used literally in the command. They represent the needed item.	Command: **:SENSe:FREQ <freq>** In this command example the word <freq> should be replaced by an actual frequency: **:SENSe:FREQ 9.7 MHz**
{ }	Parameters in braces can optionally be used in the command either not at all, once, or several times.	Command: **[SENSe:]CORRection:CSET[1]|2|3|4:DATA:MERGe <freq>,<rel_ampl>{,<freq>,<rel_ampl>}** A valid form of this command is: **[SENSe:]CORRection:CSET1:DATA:MERGe 740000,.94 1250000,.31 3320000,1.7**

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Parameters in Commands

There are four basic types of parameters: boolean, key words, variables and arbitrary block program data.

Boolean

The expression OFF|ON|0|1 is a two state boolean-type parameter. The numeric value 0 is equivalent to OFF. Any numeric value other than 0 is equivalent to ON. The numeric values of 0 or 1 are commonly used in the command instead of OFF or ON, and queries of the parameter always return a numeric value of 0 or 1.

Key Word

The parameter key words that are allowed for a particular command are defined in the command description and are separated with a vertical slash.

Units

Numerical variables may include units. The valid units for a command depends on the variable type being used. See the following variable descriptions. If no units are sent, the indicated default units will be used. Units can follow the numerical value with, or without, a space.

Variable

A variable can be entered in exponential format as well as standard numeric format. The appropriate variable range and its optional units are defined in the command description.

In addition to these values, the following key words may also be used in commands where they are applicable.

MINimum - sets the parameter to the smallest possible value.

MAXimum - sets the parameter to the largest possible value.

UP - increments the parameter.

DOWN- decrements the parameter.

Include the key word MINimum or MAXimum after the question mark in a query in order to return the numeric value of the key word.

Example query: **`[:SENSE]:FREQuency:CENTer? MAXimum`**

Variable Parameters

<ampl>,
<rel_ampl> The <ampl> (amplitude) parameter and the <rel_ampl> (relative amplitude) parameter consist of a rational number followed by optional units. Acceptable units for <ampl> include: V, mV, µV, dBm, dBmV, dBµV, Watts, W. <rel_ampl> units are given in

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dB.

<angle> An angle parameter is a rational number followed by optional units. The default units are degrees. Acceptable units include: DEG, RAD.

<file_name> A file name parameter is the name of your file including the full path. The back slash that follows the drive colon (C:\), usually used in computer paths, is not used in the SCPI command string.

<freq> A frequency parameter is a positive rational number followed by optional units. The default unit is Hz. Acceptable units include: Hz, kHz, MHz, GHz.

<integer> There are no units associated with an integer parameter.

<number> A number parameter is a member of the set of positive or negative intrigers and including zero. Fractional numbers are included in the number parameter. There are no units associated with a number parameter.

<percent> A percent parameter is a rational number between 0 and 100, with no units.

<rel_power> A relative power parameter is a positive rational number followed by optional units. The default units are dB. Acceptable units are dB only.

<string> A string parameter includes a series of alpha numeric characters.

<time> A time parameter is a rational number followed by optional units. The default units are seconds. Acceptable units include: S, MS, US.

Block Program Data

Definite length arbitrary block response data is defined in section 8.7.9.2 of IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

<definite_length_block> Allows data to be transmitted over the system interface as a series of 8 bit data bytes. This element is particularly useful for sending large quantities of data, 8 bit extended ASCII codes, or other data that are not able to be directly displayed.

A definite length block of data starts with an ASCII header that begins with # and indicates how many additional data points are following in the block. For example, if the header is #512320, then interpret the header as follows:

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- The first digit in the header (5) represents how many additional digits/bytes there are in the header.
- The numbers 12320 indicates 12 thousand, 3 hundred, 20 data bytes follow the header.
- To determine how may points in the block, divide 12320 by your selected data format bytes/point. Divide by 8 for real 64, or 4 for real 32. In this example there are 1540 points in the block if your selected data format is real 64.

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Improving Measurement Speed

There are a number of things you can do in your programs to make them run faster:

"Turn off the display updates" on page 183.

"Use binary data format instead of ASCII" on page 184.

"Minimize the number of GPIB transactions." on page 184.

"Avoid unnecessary use of *RST." on page 185.

"Minimize DUT/instrument setup changes." on page 185.

There are additional things you can do to run faster if you are using a measurement personality option (i.e. instrument Modes other than the standard Spectrum Analysis Mode). The following applies only to a specific option mode:

"Using an Option Mode: Minimize the number of GPIB transactions." on page 185.

Turn off the display updates

`:DISPlay:ENABle OFF` turns off the display. Updating the display slows down the measurement. For remote testing, since the computer is processing the data rather than a person, there is no need to display the data on the analyzer screen.

Disable auto alignment

`:CALibration:AUTO OFF` disables the automatic alignment process of the instrument. Automatic alignment processing occurs at the end of each sweep. In a stable operating environment, automatic alignment consumes very little instrument resources. However, in a high throughput application, any demand upon instrument resources affects measurement update rate.

NOTE When auto alignment is off, the **Align Now**, **All** function should be performed periodically. Refer to the appropriate "Specifications and Characteristics" chapter in the *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - E Series* or *Agilent Technologies ESA Spectrum Analyzers Specifications Guide - L Series* for more information on how often to perform **Align Now**, **All** when the auto alignment is off.

Use a fixed IF Gain range

In applications where narrow resolution bandwidths (< 1 kHz) are required and a high dynamic range is not required,
`:DISPlay:WINDow:TRACe:Y[SCALe]:LOG:RANGe:AUTO OFF` disables auto ranging and results in increased measurement update rate.

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Disable the IF/Video/Sweep output ports

If the analyzer has Options A4J (IF, Video and Sweep Ports) or AYX (Fast Time Domain Sweeps), various output signals with rear-panel ports are controlled by instrument processing. If these ports are not used in a particular application, **`:SYSTem:PORTs:IFVSweep:ENABle OFF`** can be used to disable the ports and conserve instrument resources.

Select phase noise performance

`[:SENSe]:FREQuency:SYNThesis` can be used to optimize either phase noise performance or tuning speed. In some settings optimizing for tuning speed reduces sweep time and the “re-tune” time between sweeps. In other settings only the re-tune time is improved.

Use binary data format instead of ASCII

The ASCII data format is the instrument default since it is easier for people to understand and is required by SCPI for *RST. However, data input/output is faster using the binary formats.

`:FORMat:DATA REAL,64` selects the 64-bit binary data format for all your numerical data queries. You may need to swap the byte order if you are using a PC rather than UNIX. **`NORMal`** is the default byte order. Use **`:FORMat:BORDer SWAP`** to change the byte order so that the least significant byte is sent first.

When using the binary format, data is sent in a block of bytes with an ASCII header. A data query would return the block of data in the following format: `#DNNN<nnn binary data bytes>`

To parse the data:

- Read two characters (#D), where D tells you how many N characters follow the D character.
- Read D characters, the resulting integer specifies the number of data bytes sent.
- Read the bytes into a real array.

For example, suppose the header is #512320.

- The first character/digit in the header (5) tells you how many additional digits there are in the header.
- The 12320 means 12 thousand, 3 hundred, 20 data bytes follow the header.
- Divide this number of bytes by your current data format (bytes/data point), 8 for real,64. For this example, there are 1540 data points in the block of data.

Minimize the number of GPIB transactions.

When you are using the GPIB for control of your instrument, each transaction requires driver overhead and bus handshaking, so minimizing these transactions reduces the time used.

You can reduce bus transactions by sending multiple commands per transaction.

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See the information on “Putting Multiple Commands on the Same Line” in the SCPI Language Basics section.

If you are using the pre-configured **MEASURE** key measurements and are making the same measurement multiple times with small changes in the measurement setup, use the single READ command. It is faster then using INITiate and FETCh.

Avoid unnecessary use of *RST.

Remember that *RST presets all the measurements and settings to their factory defaults and my also change the mode. This forces you to reset the measurement settings of the analyzer even if they use similar mode setup or measurement settings. See Minimize DUT/instrument setup changes. below.

Minimize DUT/instrument setup changes.

- Some instrument setup parameters are common to multiple measurements. You should look at your measurement process with a focus on minimizing setup changes. If your test process involves nested loops, make sure that the inner-most loop is the fastest. Also, check if the loops could be nested in a different order to reduce the number of parameter changes as you step through the test.
- Are you are using the pre-configured Measurements (**MEASURE** key)? Remember that if you have already set your Meas Setup parameters for a measurement, and you want to make another one of these measurements later, use READ:<meas>?. The MEASure:<meas>?. command resets all the settings to the defaults, while READ changes back to that measurement without changing the setup parameters from the previous use.
- Are you are using the pre-configured Measurements (**MEASURE** key)? Also remember that Mode Setup parameters remain constant across all the measurements (such as: center/channel frequency, amplitude, radio standard, input selection, trigger setup). You don’t have to re-initialize them each time you change to a different measurement.

Using an Option Mode: Minimize the number of GPIB transactions.

When you are using the GPIB for control of your instrument, each transaction requires driver overhead and bus handshaking, so minimizing these transactions reduces the time used.

- If you are making the same measurement multiple times with small changes in the measurement setup, use the single READ command. It is faster than using INITiate and FETCh.

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Putting Multiple Commands on the Same Line

Multiple commands can be written on the same line, reducing your code space requirement. To do this:

- Commands must be separated with a semicolon (;).
- If the commands are in different subsystems, the key word for the new subsystem must be preceded by a colon (:).
- If the commands are in the same subsystem, the full hierarchy of the command key words need not be included. The second command can start at the same key word level as the command that was just executed.

SCPI Termination and Separator Syntax

A terminator must be provided when an instrument is controlled using RS-232 (Option 1AX). There are several issues to be understood about choosing the proper SCPI terminator and separator when this is the case. There is no current SCPI standard for RS-232. Although one intent of SCPI is to be interface independent, <END> is only defined for IEEE 488 operation. At the time of this writing, the RS-232 terminator issue was in the process of being addressed in IEEE standard 1174.

A semicolon (;) is not a SCPI terminator, it is a separator. The purpose of the separator is to queue multiple commands or queries in order to obtain multiple actions and/or responses. Make sure that you do not attempt to use the semicolon as a terminator when using RS-232 control.

Basically all binary trace and response data is terminated with <NL><END>, as defined in Section 8.5 of IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

The following are some examples of good and bad commands. The examples are created from an ESA spectrum analyzer with the simple set of commands indicated below:

```
[:SENSe]
     :POWer
          [:RF]
          :ATTenuation 40dB

[:SENSe]
     :FREQuency
          :STARt
     :POWer
     [:RF]
          :MIXer
               :RANGe
              [:UPPer]
```


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```
:TRIGger
     [:SEQuence]
     :EXTernal [1]
          :SLOPe
               POSitive
```

Bad Command	Good Command
`PWR:ATT 40dB`	`POW:ATT 40dB`
The short form of **POWER** is **POW**, not **PWR**.	
`FREQ:STAR 30MHz;MIX:RANG –20dBm`	`FREQ:STAR 30MHz;POW:MIX:RANG –20dBm`
The **:MIX:RANG** command is in the same **:SENSE** subsystem as **:FREQ**, but executing the **:FREQ** command puts you back at the **:SENSE** level. You must specify **:POW** to get to the **:MIX:RANG** command.	
`FREQ:STAR 30MHz;POW:MIX RANG –20dBm`	`FREQ:STAR 30MHz;POW:MIX:RANG –20dBm`
:MIX and **:RANG** require a colon to separate them.	
`:POW:ATT 40dB;TRIG:FREQ:STAR 2.3GHz`	`:POW:ATT 40dB;:FREQ:STAR 2.3GHz`
:FREQ:STAR is in the **:SENSE** subsystem, not the **:TRIGGER** subsystem.	
`:POW:ATT?:FREQ:STAR?`	`:POW:ATT?;:FREQ:STAR?`
:POW and **:FREQ** are within the same **:SENSE** subsystem, but they are two separate commands, so they should be separated with a semicolon, not a colon.	
`:POW:ATT -5dB;:FREQ:STAR 10MHz`	`:POW:ATT 5dB;:FREQ:STAR 10MHz`
Attenuation cannot be a negative value.	

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Overview of GPIB (Option A4H)

GPIB Instrument Nomenclature

An instrument that is part of a GPIB network is categorized as a listener, talker, or controller, depending on its current function in the network.

Listener	A listener is a device capable of receiving data or commands from other instruments. Any number of instruments in the GPIB network can be listeners simultaneously.
Talker	A talker is a device capable of transmitting data or commands to other instruments. To avoid confusion, an GPIB system allows only one device at a time to be an active talker.
Controller	A controller is an instrument, typically a computer, capable of managing the various GPIB activities. Only one device at a time can be an active controller.

GPIB Command Statements

Command statements form the nucleus of GPIB programming. They are understood by all instruments in the network. When combined with the programming language codes, they provide all management and data communication instructions for the system. Refer to the programming language manual and your computers I/O programming manual for more information.

The seven fundamental command functions are as follows:

- An abort function that stops all listener/talker activity on the interface bus, and prepares all instruments to receive a new command from the controller. Typically, this is an initialization command used to place the bus in a known starting condition (sometimes called: abort, abortio, reset, halt).
- A remote function that causes an instrument to change from local control to remote control. In remote control, the front panel keys are disabled except for the Local key and the line power switch (sometimes called: remote, resume).
- A local lockout function, that can be used with the remote function, to disable the front panel Local key. With the Local key disabled, only the controller (or a hard reset by the line power switch) can restore local control (sometimes called: local).

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- A local function that is the complement to the remote command, causing an instrument to return to local control with a fully enabled front panel (sometimes called: local, resume).
- A clear function that causes all GPIB instruments, or addressed instruments, to assume a cleared condition. The definition of clear is unique for each instrument (sometimes called: clear, reset, control, send).

  In the Agilent ESA Spectrum Analyzer, clear does the following:

  1. Clears the Input Buffer and the Output Queue.
  2. Resets the parser.
  3. Clears any current operations, such as *OPC, i.e., returns the device to Operation Complete Query Idle State and Operation Complete Command Idle State.
  4. Aborts /resumes the current sweep.
- An output function that is used to send function commands and data commands from the controller to the addressed instrument (sometimes called: output, control, convert, image, iobuffer, transfer).
- An enter function that is the complement of the output function and is used to transfer data from the addressed instrument to the controller (sometimes called: enter, convert, image, iobuffer, on timeout, set timeout, transfer).

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Overview of RS-232 (Option 1AX)

Serial interface programming techniques are similar to most general I/O applications. Due to the asynchronous nature of serial I/O operations, special care must be exercised to ensure that data is not lost by sending to another device before the device is ready to receive. Modem line handshaking can he used to help solve this problem. These and other topics are discussed in greater detail in your programming language documentation.

Settings for the Serial Interface

Please refer to the documentation on your computer and I/O to configure the serial interface. Some common serial interface configuration settings are:

Baud Rate to	9600
Bits per character to	8
Parity to	Odd or disabled
Stop bits to	1

Handshake and Baud Rate

To determine hardware operating parameters, you need to know the answer for each of the following questions about the peripheral device:

- Which of the following signal and control lines are actively used during communication with the peripheral?
  - — Data Set Ready (DSR)
  - — Clear to Send (CTS)
- What baud rate is expected by the peripheral?

Character Format Parameters

To define the character format, you must know the requirements of the peripheral device for the following parameters:

- Character Length: Eight data bits are used for each character, excluding start, stop, and parity bits.
- Parity Enable: Parity is disabled (absent) for each character.
- Stop Bits: One stop bit is included with each character.

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Modem Line Handshaking

To use modem line handshaking for data transfer you would consider the following tasks:

1. Set Data Terminal Ready and Request-to-Send modem lines to active state.
2. Check Data Set Ready and Clear-to-Send modem lines to be sure they are active.
3. Send information to the interface and thence to the peripheral.
4. After data transfer is complete, clear Data Terminal Ready and Request-to-Send signals.

For ENTER operations:

1. Set Data Terminal Ready line to active state. Leave Request-to-Send inactive.
2. Check Data Set Ready and Data Carrier Detect modem lines to be sure they are active.
3. Input information from the interface as it is received from the peripheral.
4. After the input operation is complete, clear the Data Terminal Ready signal.

Data Transfer Errors

The serial interface can generate several types of errors when certain conditions are encountered while receiving data from the peripheral device. Errors can be generated by any of the following conditions:

- Parity error. The parity bit on an incoming character does not match the parity expected by the receiver. This condition is most commonly caused by line noise.
- Framing error. Start and stop bits do not match the timing expectations of the receiver. This can occur when line noise causes the receiver to miss the start bit or obscures the stop bits.
- Overrun error. Incoming data buffer overrun caused a loss of one or more data characters. This is usually caused when data is received by the interface, but no ENTER statement has been activated to input the information.
- Break received. A BREAK was sent to the interface by the peripheral device. The desktop computer program must be able to properly interpret the meaning of a break and take appropriate action.

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4 Status Registers

This chapter contains a comprehensive description of status registers explaining what status registers are and how to use them so you can use a program to monitor the instrument. Information about all of the bits of the status registers is also provided.

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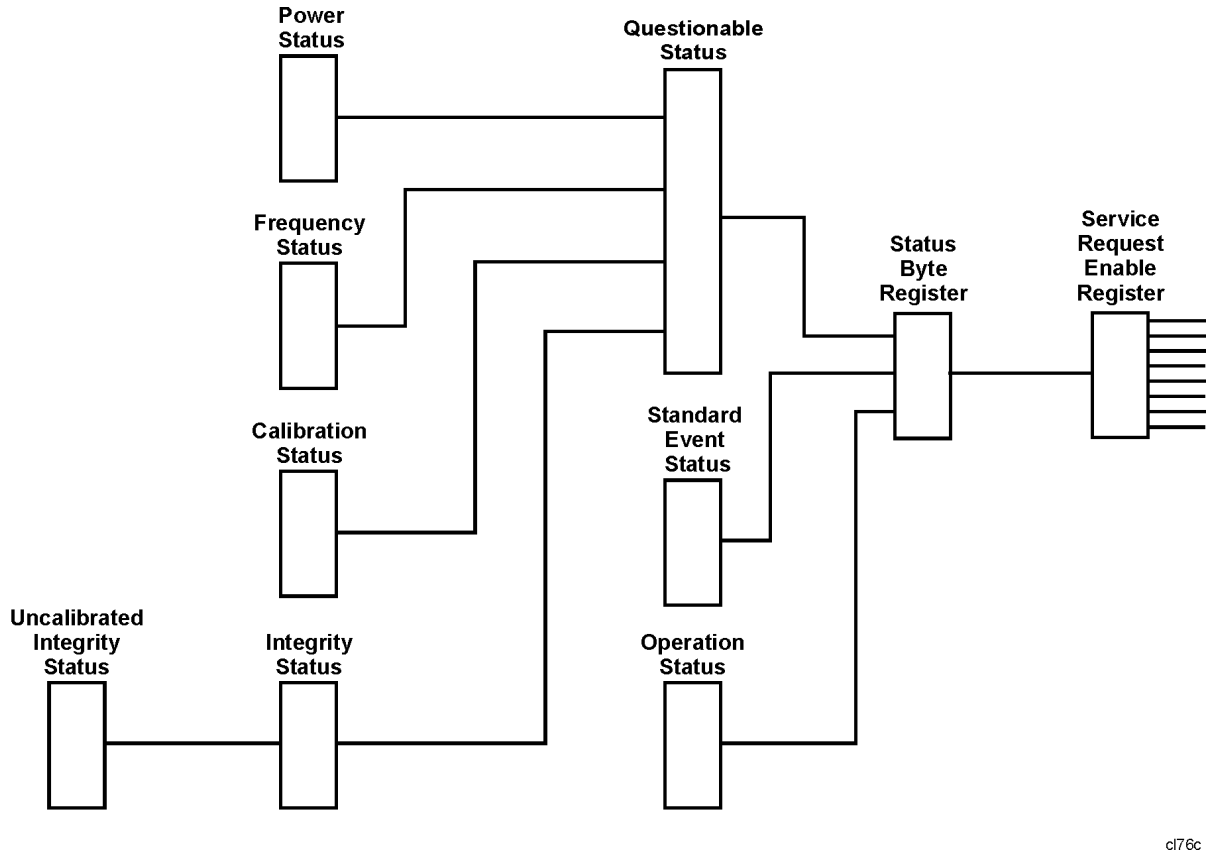
Use Status Registers to Determine the State of Analyzer Events and Conditions

Programs often need to detect and manage error conditions or changes in analyzer status. Agilent ESA products allow this function to be performed using status registers. You can determine the state of certain analyzer hardware and firmware events and conditions by programming the status register system.

Refer to Figure 4-1. The status system is comprised of multiple registers arranged in a hierarchical order. The service request enable register is at the top of the hierarchy and contains the general status information for the analyzer events and conditions. The lower-priority status registers propagate their data to the higher-priority registers in the data structures by means of summary bits. These registers are used to determine the states of specific events or conditions.

Figure 4-1 Status Register System Simplified Block Diagram



The two methods used to programmatically access the information in status registers are the polling method and the service request method. An explanation of these methods is given in the next section "What are the Status Registers?"

What are the Status Registers?

Refer to Figure 4-2, which shows the overall status register system in detail. Most status registers are

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composed of the five individual registers described below. One such status register in the figure is entitled “STATus: QUEStionable,” which is both the name of the register, and the SCPI command form used to access the register. From now on, the SCPI command form will be used when referring to the various registers. There are IEEE common SCPI commands noted under some register names in parenthesis. These commands are associated with those registers, and their effects are described under “How Do You Access the Status Registers?” in this chapter, and in the beginning of Chapter 5, “Remote Command Reference.” in this guide.

Refer to the right-hand part of the STATus: QUEStionable register while reading the following register descriptions.

Condition Register	A condition register continuously monitors the hardware and firmware status of the analyzer. There is no latching or buffering for a condition register.
Negative Transition Filter	A negative transition filter specifies the bits in the condition register that will set corresponding bits in the event register when the condition bit changes from 1 to 0.
Positive Transition Filter	A positive transition filter specifies the bits in the condition register that will set corresponding bits in the event register when the condition bit changes from 0 to 1.
Event Register	An event register latches transition events from the condition register as specified by the positive and negative transition filters. Bits in the event register are latched, and once set, they remain set until cleared by either querying the register contents or sending the **`*CLS`** command.
Event Enable Register	An event enable register specifies the bits in the event register that can generate a summary bit. Summary bits are, in turn, used by the status byte register.

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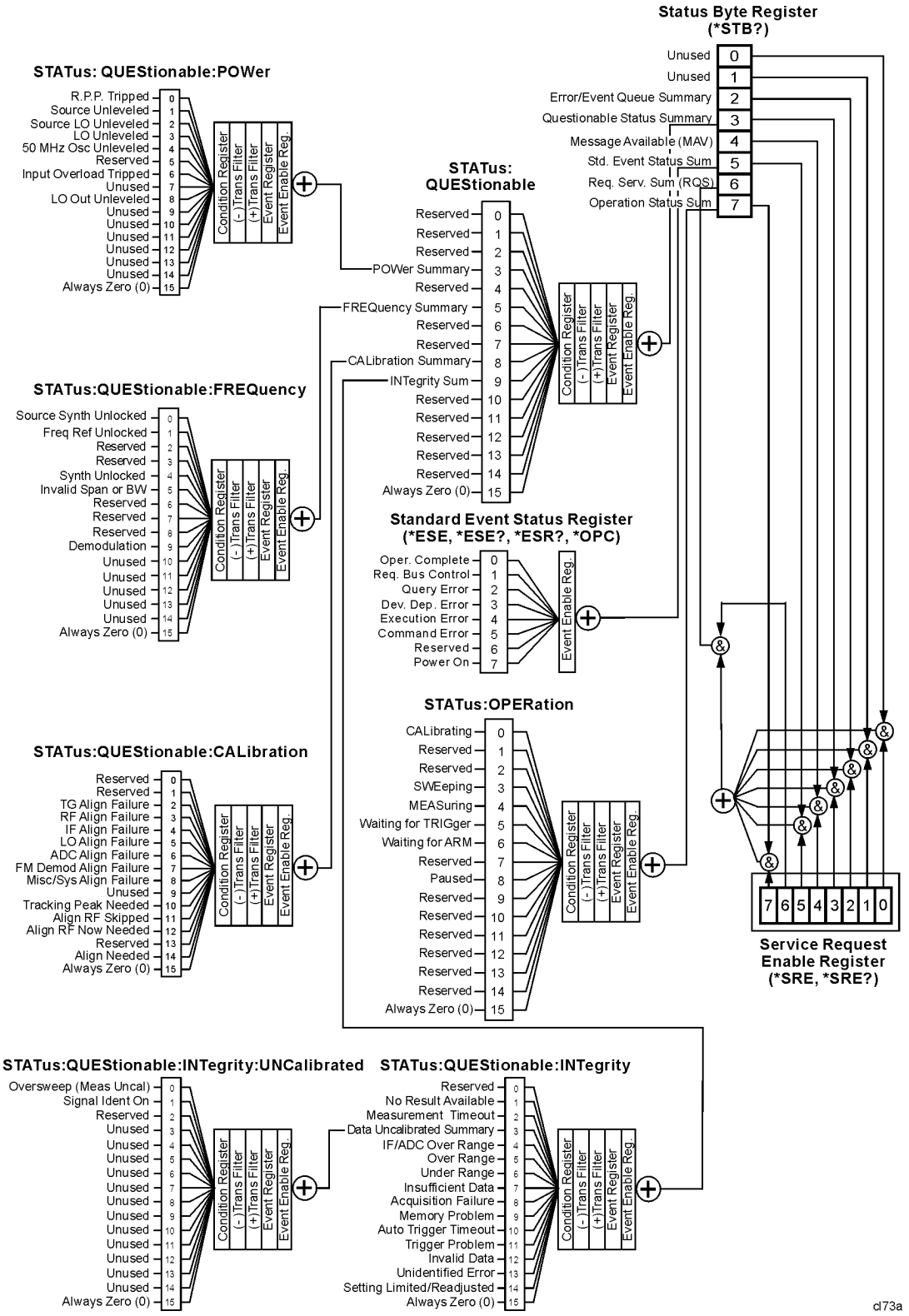
Figure 4-2 Overall Status Register System Diagram



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Status registers (except for the status byte register and the standard event status register) consist of the registers whose contents can be used to produce status summary bits.

These summary bits are then manipulated as follows: The condition register passes summary bits to the negative and positive transition filters, after which they are stored in the event register. The contents of the event register are logically ANDed with the contents of the event enable register and the result is logically ORed to produce a status summary bit. The status summary bit is then passed to the status byte register either directly, or through the STATus: QUEStionable register. Next, the summary bits are logically ANDed with the contents of the service request enable register and the result is logically ORed to produce the request service (**`*RQS`**) bit in the status byte register.

How Do You Access the Status Registers?

There are two different methods to access the status registers:

- Common Commands Accesses and Controls
- Status Subsystem Commands

Common Command Access and Control

Most monitoring of the analyzer conditions is done at the highest level using the following IEEE common commands:

`*CLS` (clear status) clears the status byte by emptying the error queue and clearing all the event registers.

`*ESE,*ESE?` (event status enable) sets and queries the bits in the enable register part of the standard event status register.

`*ESR?` (event status register) queries and clears the standard event status register.

`*OPC` (operation complete) sets bit 0 in the standard event status register when all operations are complete.

`*SRE,*SRE?` (service request enable) sets and queries the value of the service request enable register.

`*STB?` (status byte) queries the value of the status byte register without erasing its contents.

Complete command descriptions are given in Chapter 5, “Remote Command Reference.” under the subsection entitled “IEEE Common Commands” on page 231.

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NOTE

If you are using the status bits and the analyzer mode is changed, the status bits should be read, and any error conditions resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Status Subsystem Commands

Individual status registers can be set and queried using the commands in the STATus subsystem in Chapter 5, "Remote Command Reference." in this guide. There are two methods used to programmatically detect and manage error conditions or changes in analyzer status. Either method allows you to monitor one or more conditions. The two methods are:

- The Polling Method
- The Service Request (SRQ) Method

The Polling Method

In the polling method, the analyzer has a passive role. It only tells the controller that conditions have changed when the controller asks the right question. The polling method works well if you do not need to know about changes the moment they occur. This method is very efficient.

Use the polling method when either:

— your programming language/development environment does not support SRQ interrupts
— you want to write a simple, single-purpose program and don't want the added complexity of setting up an SRQ handler

The Service Request (SRQ) Method

The SRQ method allows timely communication of information without requiring continuous controller involvement. Using this method, the analyzer takes a more active role. It tells the controller when there has been a condition change without the controller asking. The SRQ method should be used if you must know immediately when a condition changes. This is in contrast to the polling method, which requires the program to repeatedly read the registers to detect a change.

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Use the SRQ method when either:

— you need time-critical notification of changes
— you are monitoring more than one device which supports SRQs
— you need to have the controller do something else while the analyzer is making a measurement
— you can't afford the performance penalty inherent to polling

Using the Service Request (SRQ) Method

Your language, bus, and programming environment must be able to support SRQ interrupts (for example, using C and C++ with the GPIB). When you monitor a condition with the SRQ method, you must establish the following parameters:

1. Determine which bit monitors the condition.
2. Determine how that bit reports to the request service (RQS) bit of the status byte.
3. Send GPIB commands to enable the bits that monitor the condition and to enable the summary bits that report the condition to the RQS bit.
4. Enable the controller to respond to service requests.

When the condition changes, the analyzer sets the RQS bit and the GPIB SRQ line. The controller is informed of the change as soon as it occurs. The time the controller would otherwise have used to monitor the condition can now be used to perform other tasks. Your program also determines how the controller responds to the SRQ.

Generating a Service Request

Before using the SRQ method of generating a service request, first become familiar with how service requests are generated. Bit 6 of the status byte register is the request service summary (RQS) bit. The RQS bit is set whenever there is a change in the register bit that it has been configured to monitor. The RQS bit will remain set until the condition that caused it is cleared. It can be queried without erasing the contents using the **`*STB?`** command. Configure the RQS function using the **`*SRE`** command.

When a register set causes a summary bit in the status byte to change from 0 to 1, the analyzer can initiate the service request (SRQ) process. However, the process is only initiated if both of the following conditions are true:

- The corresponding bit of the service request enable register is also set to 1.
- The analyzer does not have a service request pending. (A service request is considered to be pending between the time the analyzer SRQ process is initiated, and the time the controller reads the status byte register.)

The SRQ process sets the GPIB SRQ line true. It also sets the status byte request service (RQS) bit to 1. Both actions are necessary to inform the controller that the analyzer requires service. Setting the SRQ line only informs the controller that some device on the bus requires service. Setting the RQS bit allows the controller to determine which device requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the GPIB SRQ line is set true. Each device on the bus returns the contents of its status byte register in response to this poll. The device, whose RQS bit is set to 1, is the device that requested service.

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NOTE When you read the analyzer status byte register with a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.

Restarting a measurement with the **:INITiate** command can cause the measuring bit to pulse low. A low pulse causes an SRQ if the status register is configured to SRQ upon end-of-measurement. To avoid this, perform the following steps:

1. Set **:INITiate:CONTinuous** off.
2. Set/enable the status registers.
3. Restart the measurement (send **:INITiate**).

Example of Monitoring Conditions Using the :STATus Command

Use the following steps to monitor a *specific* condition:

1. Determine which register contains the bit that reports the condition.
2. Send the unique SCPI query that reads that register.
3. Examine the bit to see if the condition has changed.
4. Act upon the cause of the condition and the SRQ to re-enable the method.

The examples below show how to use the **:STATus** command to perform the following tasks:

- Check the analyzer hardware and firmware status.
  Do this by querying the condition registers which continuously monitor status. These registers represent the current state of the analyzer. Bits in a condition register are updated in real time. When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0.
- Monitor a particular bit (condition), or bits.
  Once you have enabled a bit using the event enable register, the analyzer will monitor that particular bit. If the bit becomes true in the event register it will stay set until the event register is cleared. Querying the event register allows you to detect that this condition occurred even if the condition no longer exists. The event register can only be cleared by querying it or sending the ***CLS** command, which clears all event registers.
- Monitor a change in the condition of a particular bit, or bits.
  Once you have enabled a bit, the analyzer will monitor it for a change in its condition. The transition registers are preset to respond to the condition of going from 0 to 1 (positive transitions). This can be changed so that the selected bit is detected if it goes from 1 to 0 (negative transition), or if either transition occurs. Query the event register to determine whether or not a change has been made to how the transition registers respond. The event register can only be cleared by querying it or sending the ***CLS** command, which clears all event registers.

Setting and Querying the Status Register

See Figure 4-3. Each bit in a register is represented by a numerical value based on its location. This number is sent with the command to enable a particular bit. To enable more than one bit, send the sum of all of the bits involved.

For example, to enable bit 0 and bit 6 of the standard event status register, you would send the command ***ESE 65** (1 + 64).

The results of a query are evaluated in a similar way. If the ***STB?** command returns a decimal value of 140, (140 = 128 + 8 + 4) then bit 7 is true, bit 3 is true, and bit 2 is true.

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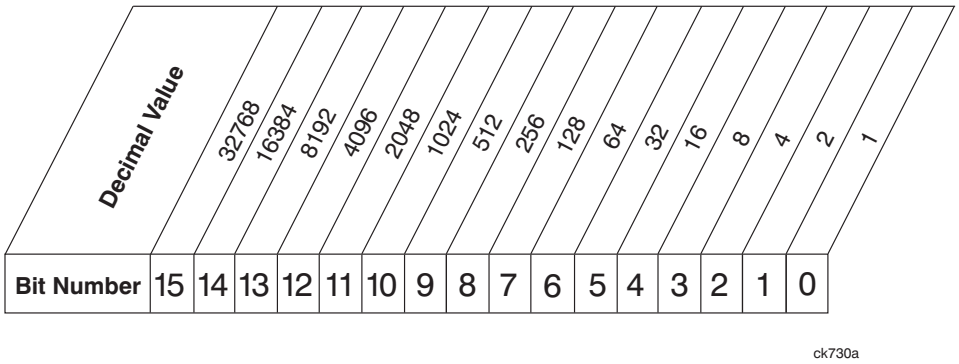
Figure 4-3 Status Register Bit Values

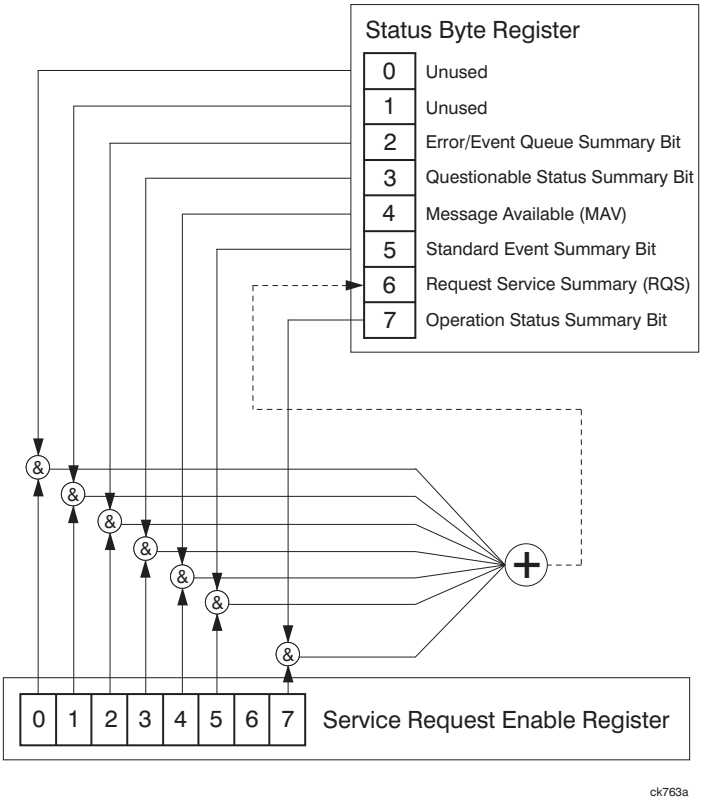


Details of Bits in All Registers

Refer to Figure 4-2. The rest of this chapter lists the bits in each register shown in the figure, along with descriptions of their purpose.

Status Byte Register

Figure 4-4 Status Byte Register Diagram



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The status byte register contains the following bits:

Bit	Decimal Value	Description
0	1	**Unused**: This bit is always set to 0.
1	2	**Unused**: This bit is always set to 0.
2	4	**Error/Event Queue Summery Bit**: A 1 in this bit position indicates that the SCPI error queue is not empty. The SCPI error queue contains at least one error message.
3	8	**Questionable Status Summary Bit**: A 1 in this bit position indicates that the questionable status summary bit has been set. The questionable status event register can then be read to determine the specific condition that caused this bit to be set.
4	16	**Message Available (MAV)**: A 1 in this bit position indicates that the analyzer has data ready in the output queue. There are no lower status groups that provide input to this bit.
5	32	**Standard Event Status Summary Bit**: A 1 in this bit position indicates that the standard event status summary bit has been set. The standard event status register can then be read to determine the specific event that caused this bit to be set.
6	64	**Request Service (RQS) Summery Bit**: A 1 in this bit position indicates that the analyzer has at least one reason to report a status change. This bit is also called the master summary status bit (MSS).
7	128	**Operation Status Summary Bit**: A 1 in this bit position indicates that the operation status summary bit has been set. The operation status event register can then be read to determine the specific event that caused this bit to be set.

To query the status byte register, send the ***STB** command. The response will be the *decimal* sum of the bits that are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned.

Service Request Enable Register

In addition to the status byte register, the status byte group also contains the service request enable register. The status byte service request enable register lets you choose which bits in the Status Byte Register will trigger a service request.

Send the ***SRE <number>** command (where **<number>** is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6). For example, assume that you want to enable bit 7 so that whenever the operation status summary bit is set to 1, it will trigger a service request. Send the ***SRE 192** (128 + 64) command. The ***SRE?** command returns the decimal value of the sum of the bits enabled previously with the ***SRE <number>** command.

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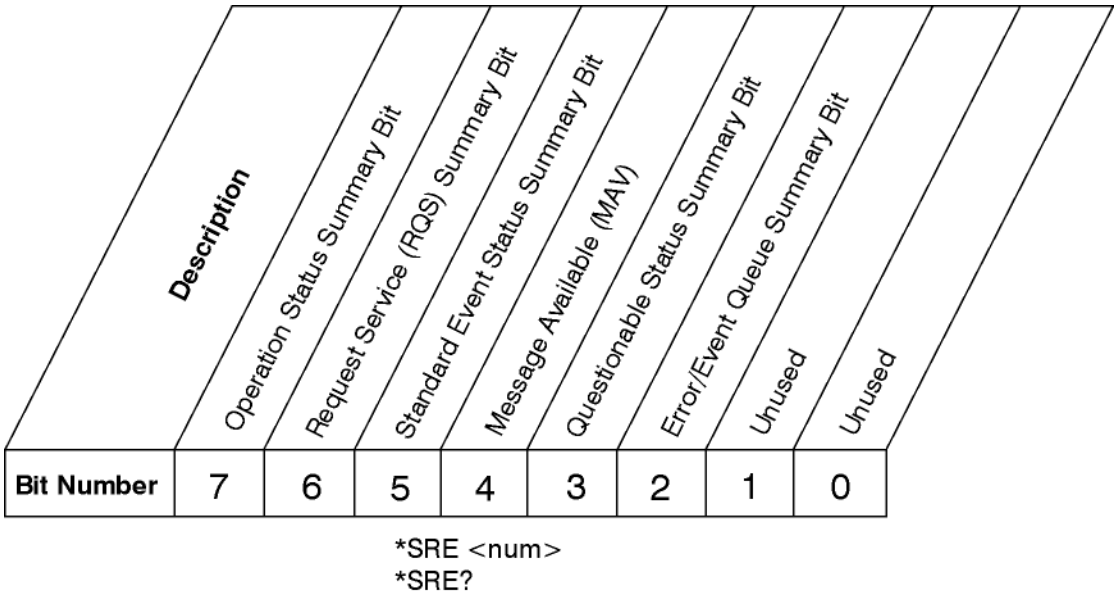
NOTE You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request.

The service request enable register contains the following bits:

Figure 4-5 Service Request Enable Register



NOTE The service request enable register presets to zeros (0).

Standard Event Status Register

The standard event status register is used to determine the specific event that sets bit 5 in the status byte register. The standard event status register does *not* have negative and positive transition registers, nor a condition register. Use the IEEE common commands at the beginning of Chapter 5, "Remote Command Reference." in this guide to access the register.

To query the standard event status register, send the **`*ESR`** command. The response will be the *decimal* sum of the bits which are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned.

See "Setting and Querying the Status Register" on page 200 in this chapter for more information.

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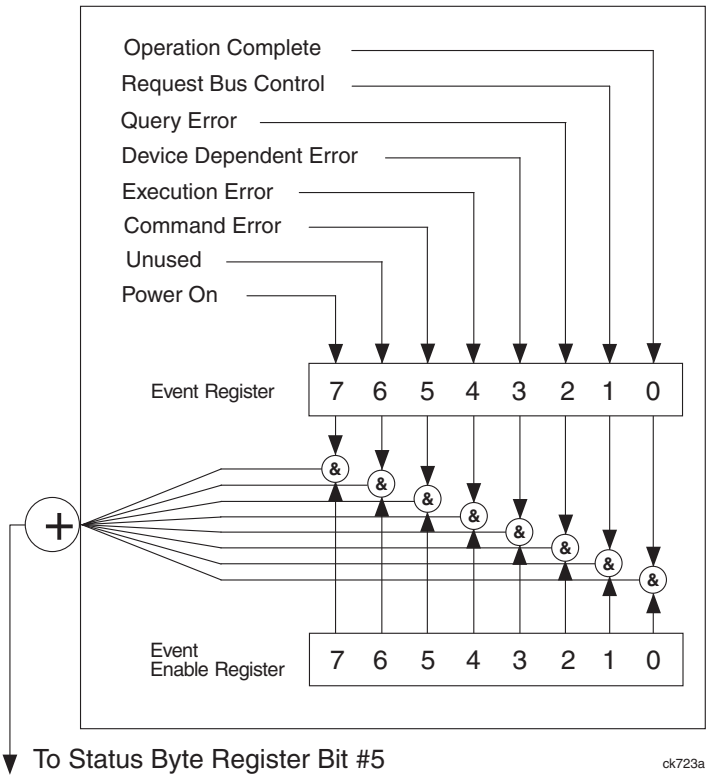
Figure 4-6 Standard Event Status Register Diagram



The standard event status register contains the following bits:

Bit	Decimal Value	Description
0	1	**`Operation Complete`**: A 1 in this bit position indicates that all operations were completed following execution of the **`*OPC`** command.
1	2	**`Request Bus Control`**: This bit is always set to 0. (The analyzer does not request control.)
2	4	**`Query Error`**: A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from –499 to –400.
3	8	**`Device Dependent Error`**: A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from –399 to –300 and 1 to 32767.
4	16	**`Execution Error`**: A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from –299 to –200.

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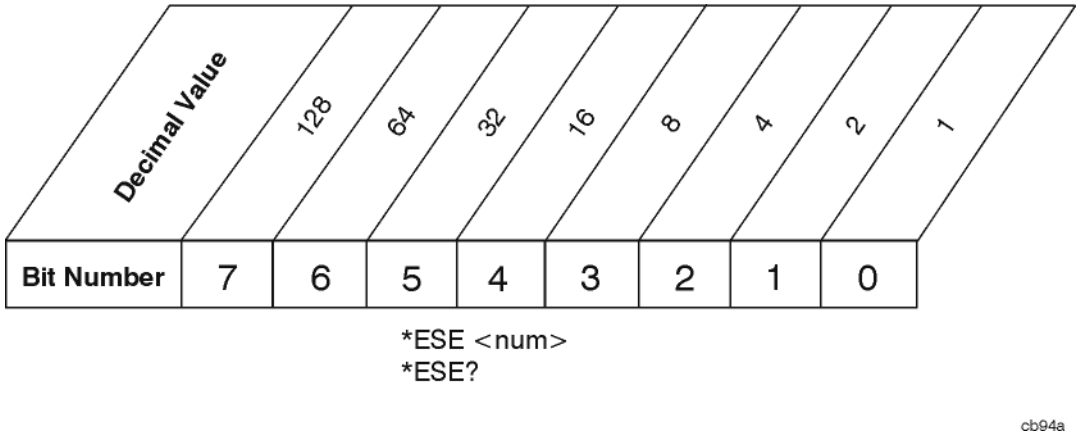
Bit	Decimal Value	Description
5	32	**Command Error**: A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from –199 to –100.
6	64	**Unused**: This bit is always set to 0.
7	128	**Power On**: A 1 in this bit position indicates that the analyzer has been turned off and then on.

Standard Event Status Event Enable Register

The event enable register (contained in the standard event status register) lets you choose which bits will set the summary bit (bit 5 of the status byte register) to 1. Send the ***ESE <number>** command (where **<number>** is the sum of the decimal values of the bits you want to enable).

For example, to enable bit 7 and bit 3 so that whenever either of those bits is set to 1, the standard event status summary bit of the status byte register will also be set to 1, send the ***ESE 136** (128 + 8) command. The ***ESE?** command returns the decimal value of the sum of the bits previously enabled with the ***ESE <number>** command.

Figure 4-7 Standard Event Status Event Enable Register



STATus:OPERation Register

The STATus:OPERation register is used to determine the specific event that sets bit 7 in the status byte register. This register also monitors the current measurement state and checks to see if the analyzer is performing any of these functions:

- measuring
- calibrating
- sweeping
- waiting for a trigger

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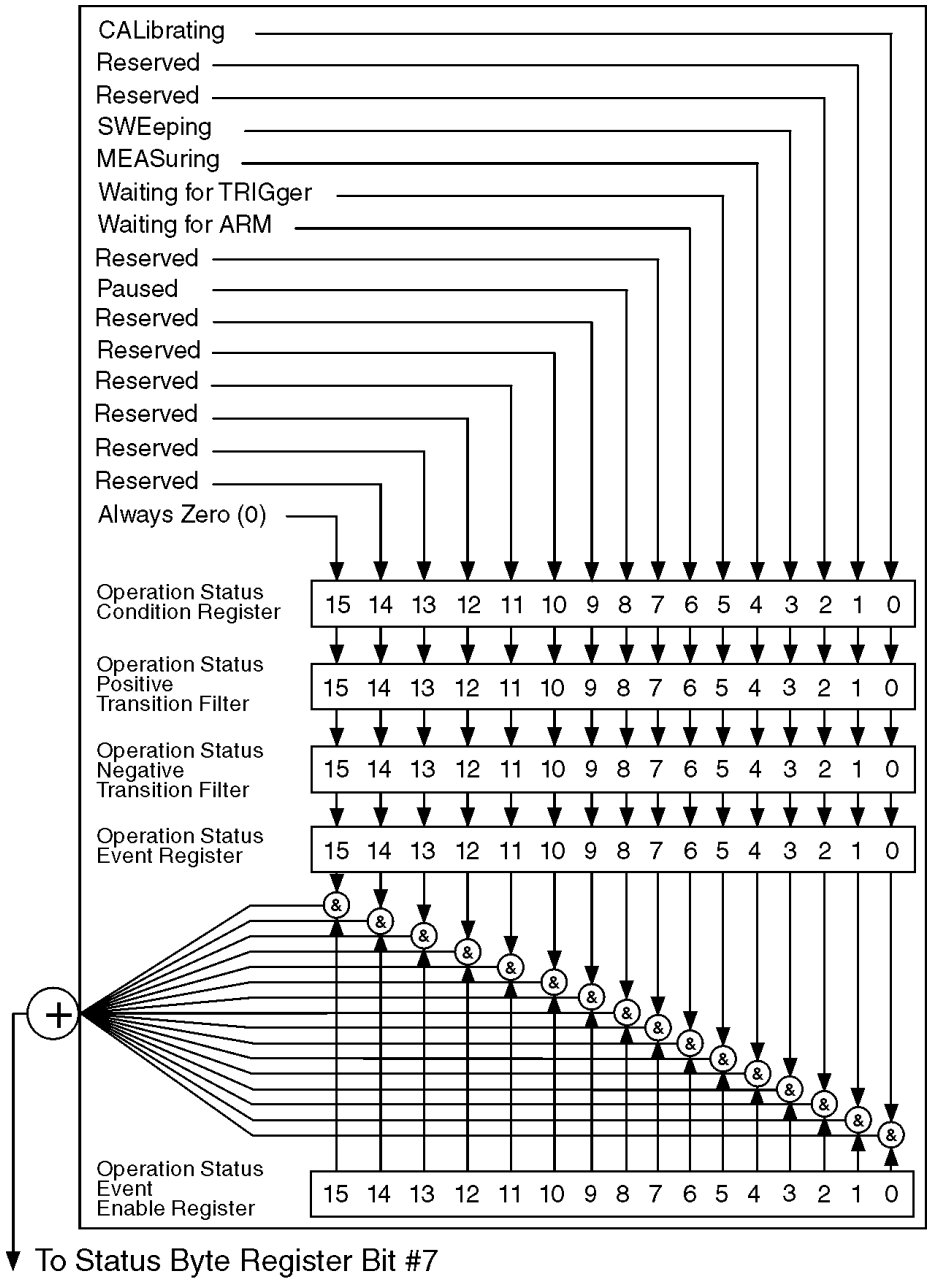
Figure 4-8 Status Operation Register Diagram



The STATus:OPERation condition register contains the following bits:

Bit	Decimal Value	Description
0	0	**`Calibrating`**: A 1 in this bit position indicates that the analyzer is performing a self-calibration.

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Bit	Decimal Value	Description
1	2	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
2	4	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
3	8	**Sweeping**: A 1 in this bit position indicates that a sweep is in progress.
4[a]	16	**Measuring**: A 1 in this bit position indicates that a measurement is in progress.
5[a]	32	**Waiting for Trigger**: A 1 in this bit position indicates that a measurement is in a “wait for trigger” state.
6	64	**Waiting for ARM:** A 1 in this bit position indicates that the hardware is being set up and is not yet ready to be triggered.
7	128	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
8[b]	256	**Paused**: A 1 in this bit position indicates that the instrument is in the paused state of the measurement.
9	512	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
10	1024	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
11	2048	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
12	4096	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
13	8192	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
14	16384	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
15	32768	**Always Zero (0)**

a. The description of this bit refers to any measurement under the **MEASURE** key.
b. This bit applies to ESA optional measurement personalities only, and may or may not be implemented in all such personalities.

STATus:OPERation Condition and Event Enable Registers

The STATus:OPERation condition register continuously monitors the hardware and firmware status of the analyzer, and is read-only. To query the register, send the `:STATus:OPERation:CONDition?` command. The response will be the *decimal* sum of the bits that are set to 1. For example, if bit number

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9 and bit number 3 are set to 1, the decimal sum of the 2 bits is 512 plus 8. So the decimal value 520 is returned.

The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the **:STATus:OPERation:NTRansition <num>** (negative transition) command or the **:STATus:OPERation:PTRansition <num>** (positive transition) command (where **<num>** is the sum of the decimal values of the bits you want to enable).

The STATus:OPERation event register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only data. Reading data from an event register will clear the content of that register. To query the event register, send the **:STATus:OPERation:[:EVENt]?** command.

The STATus:OPERation event enable register lets you choose the bits that will set the operation status summary bit (bit 7) of the status byte register to 1. Send the **:STATus:OPERation:ENABle <num>** command where **<num>** is the sum of the decimal values of the bits you want to enable.

For example, to enable bit 9 and bit 3 (so that whenever either bit 9 or 3 is set to 1, the operation status summary bit of the status byte register will be set to 1), send the `:STATus:OPERation:ENABle 520` (512 + 8) command. The `:STATus:OPERation:ENABle?` command returns the decimal value of the sum of the bits previously enabled with the `:STATus:OPERation:ENABle <num>` command.

STATus:QUEStionable Registers

STATus:QUEStionable registers monitor the overall analyzer condition. They are accessed with the **:STATus:OPERation** and **:STATus:QUEStionable** commands in the **:STATus** command subsystem.

The STATus:QUEStionable registers also monitor the analyzer to see if there are any questionable events that occurred. These registers look for anything that may cause an error or that may induce a faulty measurement. Signs of a faulty measurement include the following:

- hardware problems
- out of calibration situations
- unusual signals

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NOTE All bits are summary bits from lower-level event registers. (For a general diagram of the STATus:QUEStionable register, see Figure 4-9.)

A Questionable Status condition register query response will be the decimal sum of the bits which are set to 1. For example, if bit number 9 and bit number 3 are set to 1, the decimal sum of the 2 bits is 512 plus 8. So the decimal value 520 is returned.

The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **`:STATus:QUEStionable:NTRansition <num>`** (negative transition) or **`:STATus:QUEStionable:PTRansition <num>`** (positive transition) where **`<num>`** is the sum of the decimal values of the bits you want to enable.

The Questionable Status event register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **`:STATus:QUEStionable[:EVENt]?`**

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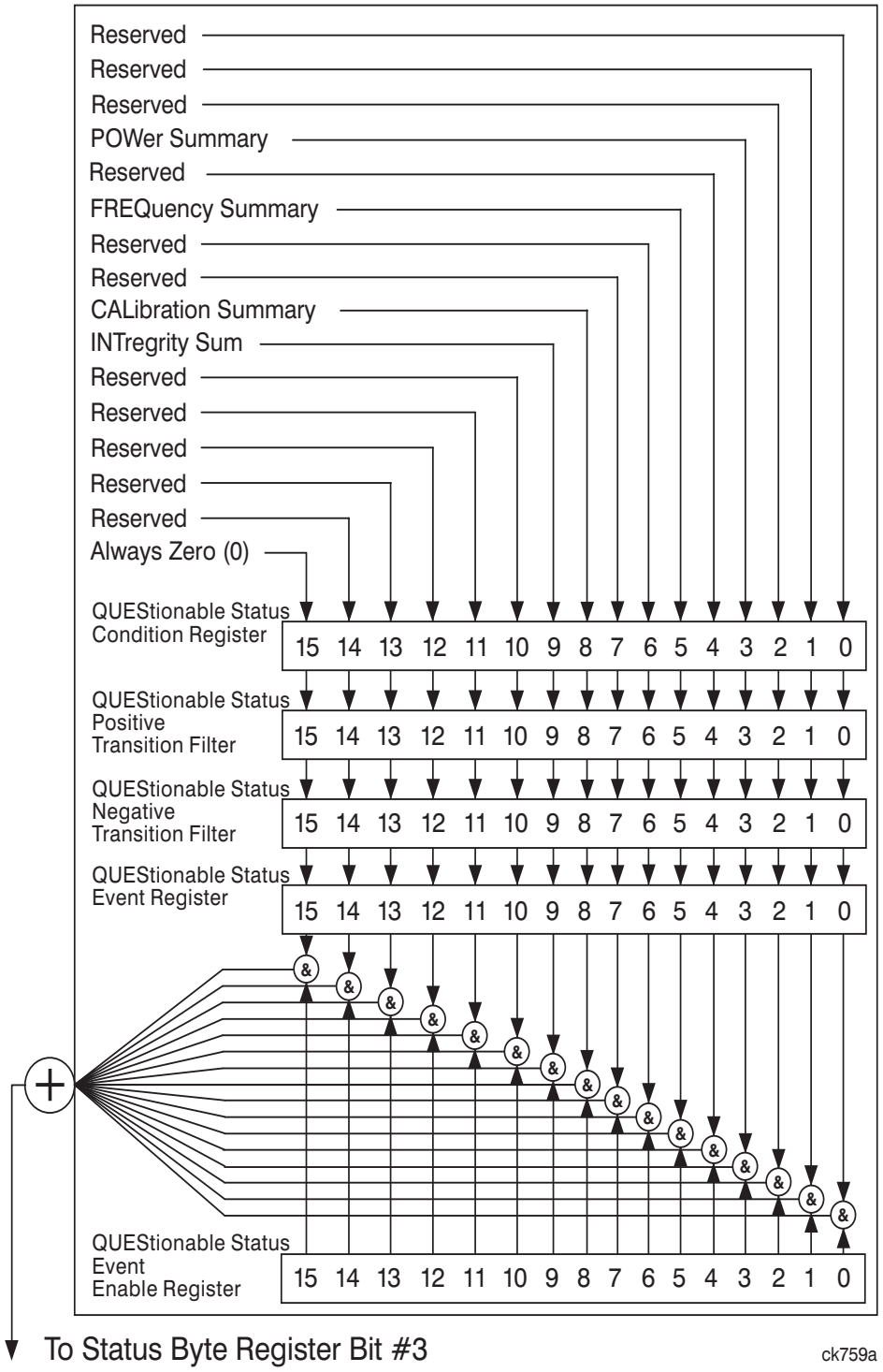
Figure 4-9 **Status Questionable Register Diagram**



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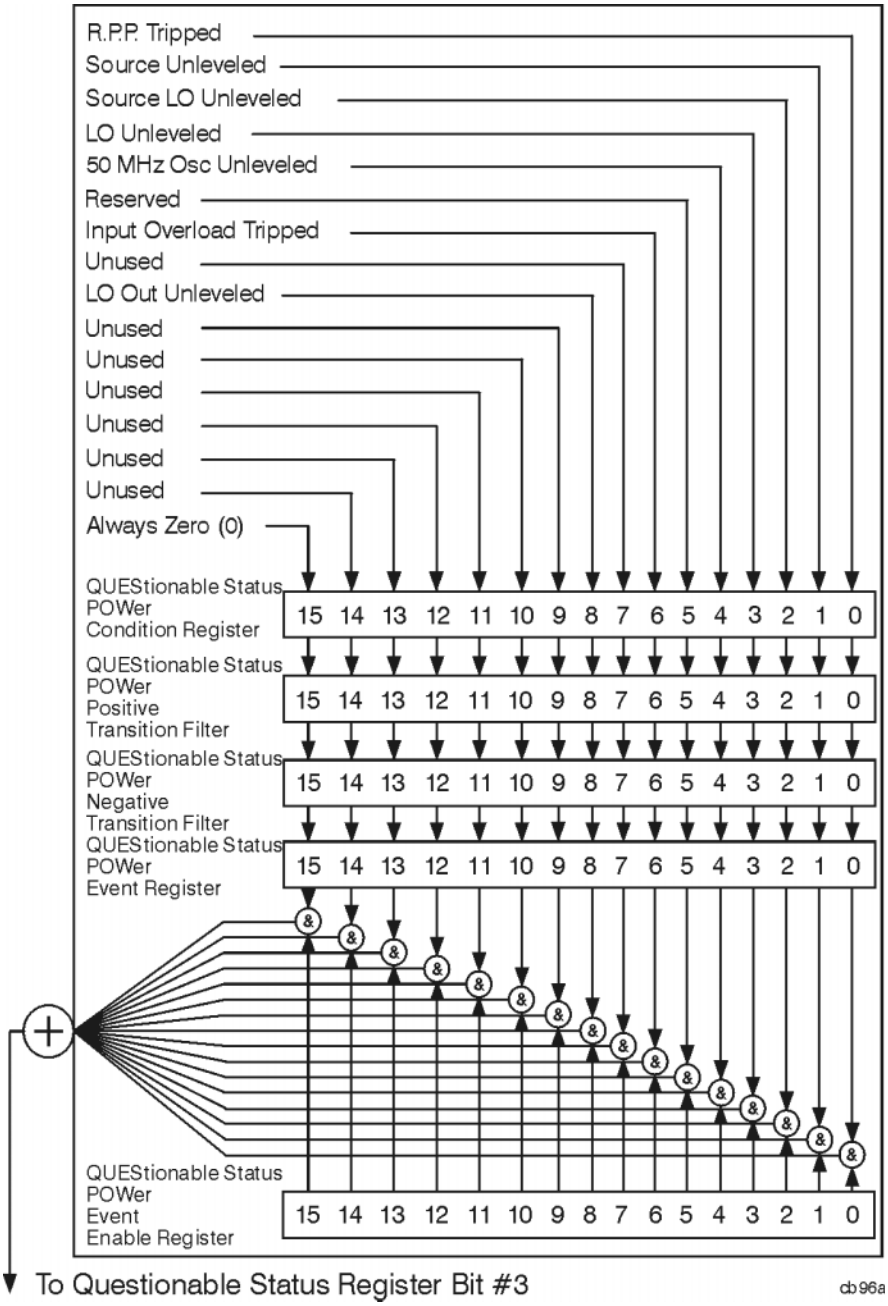
STATus:QUEStionable:POWer Register

Figure 4-10 Questionable Status Power Register Diagram



Bit descriptions in the Questionable Status Power Condition Register are given in the following table.

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Bit	Decimal Value	Description
0	0	**R.P.P Tripped**: A 1 in this bit position indicates that the reverse power protection is tripped (Agilent ESA models E4401B and E4411B only). Reverse power protection is "overload" protection for the tracking generator.
1	2	**Source Unleveled**: A 1 in this bit position indicates that the source (tracking generator) output is unleveled.
2	4	**Source LO Unleveled**: A 1 in this bit position indicates that the local oscillator (LO) in the source (tracking generator) is unleveled.
3	8	**LO Unleveled**: A 1 in this bit position indicates that the analyzer local oscillator (LO) is unleveled.
4	16	**50 MHz Osc Unleveled**: A 1 in this bit position indicates that the 50 MHz amplitude reference signal is unleveled.
5	32	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
6	64	**Input Overload Tripped**: A 1 in this bit position indicates that the input overload protection is tripped (Agilent ESA models E4401B and E4411B only).
7	128	**Unused**: This bit is always set to 0.
8	256	**LO Out Unleveled**: A 1 in this bit position indicates that the first local oscillator (LO) output is unleveled. (Agilent ESA model E4407B option AYZ, External Mixing, only).
9	512	**Unused**: This bit is always set to 0.
10	1024	**Unused**: This bit is always set to 0.
11	2048	**Unused**: This bit is always set to 0.
12	4096	**Unused**: This bit is always set to 0.
13	8192	**Unused**: This bit is always set to 0.
14	16384	**Unused**: This bit is always set to 0.
15	32768	**Always Zero (0)**: This bit is always set to 0.

Questionable Status Event Enable Register

The Questionable Status Event Enable Register lets you choose which bits in the Questionable Status Event Register will set the summary bit (bit 3 of the Status Byte Register) to 1. Send the command `:STATus:QUEStionable:ENABle <num>` where `<num>` is the sum of the decimal values of the bits you want to enable.

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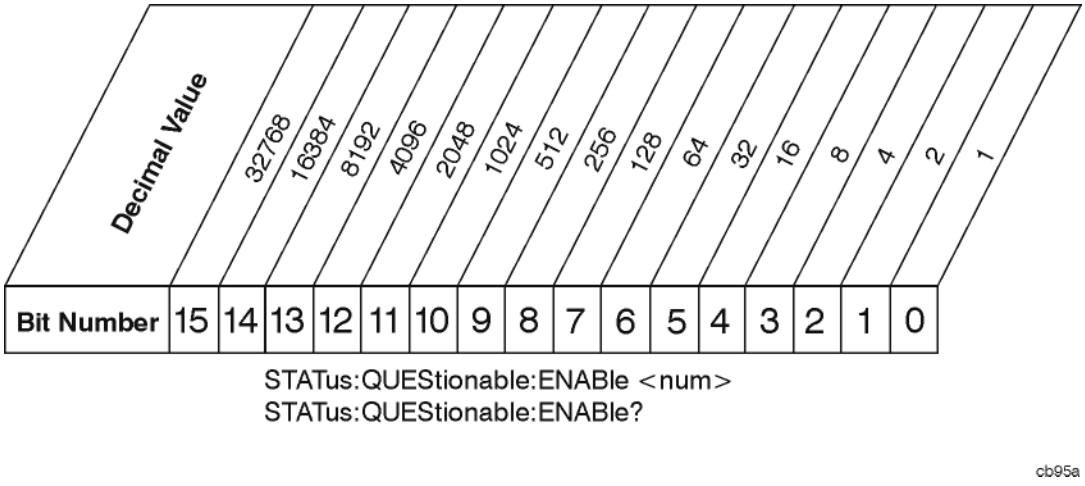
For example, to enable bit 9 and bit 3 so that whenever either of those bits is set to 1, the Questionable Status Summary bit of the Status Byte Register will be set to 1, send the command **`:STAT:QUES:ENAB 520`** (512 + 8). The command **`:STATus:QUEStionable:ENABle?`** returns the decimal value of the sum of the bits previously enabled with the **`:STATus:QUEStionable:ENABle <num>`** command.

Figure 4-11 Questionable Status Event Enable Register



Bit descriptions in the Status Questionable Condition Register are given in the following table.

Bit	Decimal Value	Description
0	1	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.
1	2	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.
2	4	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.
3	8	**`POWer Summary`**: This is the summary bit for the Questionable Power Status Register.
4	16	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.
5	32	**`FREQuency Summary`**: This is the summary bit for the Questionable Frequency Status Register.
6	64	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.
7	128	**`Reserved`**: This bit is not used by the analyzer, but are for future use with other Agilent products.

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Bit	Decimal Value	Description
8	256	**CALibration Summary**: This is the summary bit for the Questionable Calibration Status Register.
9	512	**INTegrity Sum**: This is the summary bit for the Questionable Integrity Status Register.
10	1024	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
11	2048	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
12	4096	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
13	8192	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
14	16384	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
15	32768	**Always Zero (0)**

Questionable Status Power Condition and Event Registers

The Questionable Status Power Condition Register continuously monitors output power status of the analyzer. Condition registers are read-only. To query the condition register, send the command **:STATus:QUEStionable:POWer:CONDition?** The response will be the decimal sum of the bits which are set to 1.

The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **:STATus:QUEStionable:POWer:NTRansition <num>** (negative transition) or **:STATus:QUEStionable:POWer:PTRansition <num>** (positive transition) where **<num>** is the sum of the decimal values of the bits you want to enable.

The Questionable Status Power Event Register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **:STATus:QUEStionable:POWer[:EVENt]?**

See "Questionable Status Event Enable Register" on page 212 for an explanation of how to set the summary bit using the event enable register. In this case, use the command **:STATus:QUEStionable:POWer:ENABle <num>**.

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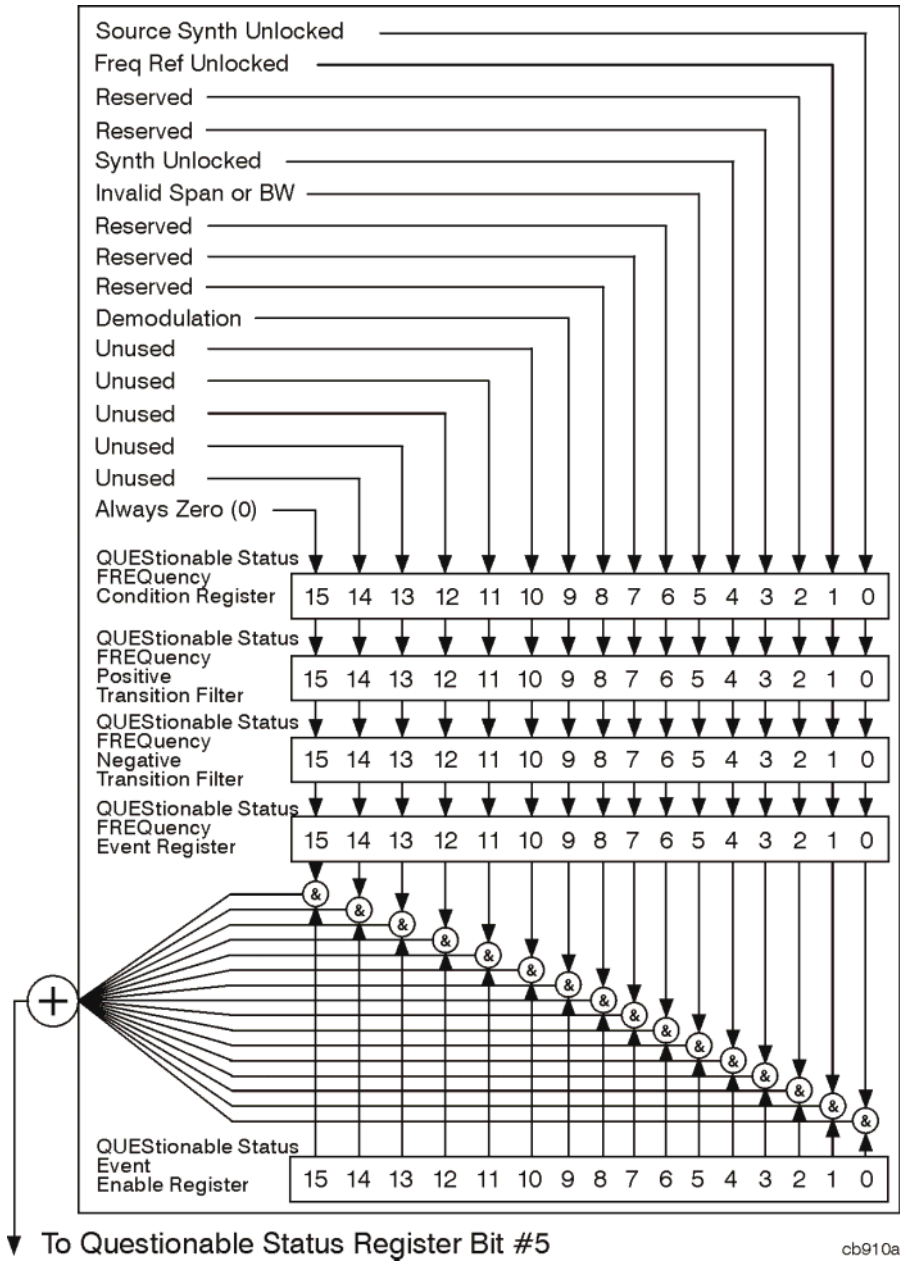
STATus:QUEStionable:FREQuency Register

Figure 4-12 Questionable Status Frequency Register Diagram



Bit descriptions in the Questionable Status Frequency Condition Register are given in the following table.

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Bit	Decimal Value	Description
0	0	**Source Synth Unlocked**: A 1 in this bit position indicates that the synthesizer in the source (tracking generator) is unlocked.
1	2	**Freq Ref Unlocked**: A 1 in this bit position indicates that the analyzer frequency reference is unlocked.
2	4	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
3	8	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
4	16	**Synth Unlocked**: A 1 in this bit position indicates that the analyzer synthesizer is unlocked.
5	32	**Invalid Span or BW**: A 1 in this bit position indicates an invalid span or bandwidth during frequency count.
6	64	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
7	128	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
8	256	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
9	512	**Demodulation**: A 1 in this bit position indicates an invalid span during FM Demodulation and Listen measurements.
10	1024	**Unused**: This bit is always set to 0.
11	2048	**Unused**: This bit is always set to 0.
12	4096	**Unused**: This bit is always set to 0.
13	8192	**Unused**: This bit is always set to 0.
14	16384	**Unused**: This bit is always set to 0.
15	32768	**Always Zero (0)**: This bit is always set to 0.

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Questionable Status Frequency Condition and Event Enable Registers

The Questionable Status Frequency condition register continuously monitors output frequency status of the analyzer. Condition registers are read-only. To query the condition register, send the command `:STATus:QUEStionable:FREQuency:CONDition?` The response will be the *decimal* sum of the bits which are set to 1.

The negative and positive transition filters specify which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **`:STATus:QUEStionable:FREQuency :NTRansition <num>`** (negative transition) or **`:STATus:QUEStionable :FREQuency:PTRansition <num>`** (positive transition) where **`<num>`** is the sum of the decimal values of the bits you want to enable.

The Questionable Status Frequency Event register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **`:STATus:QUEStionable:FREQuency [:EVENt]?`**

See “Questionable Status Event Enable Register” on page 212 for an explanation of how to set the summary bit using the event enable register. In this case, use the command **`:STATus:QUEStionable:FREQ:ENABle <num>`**.

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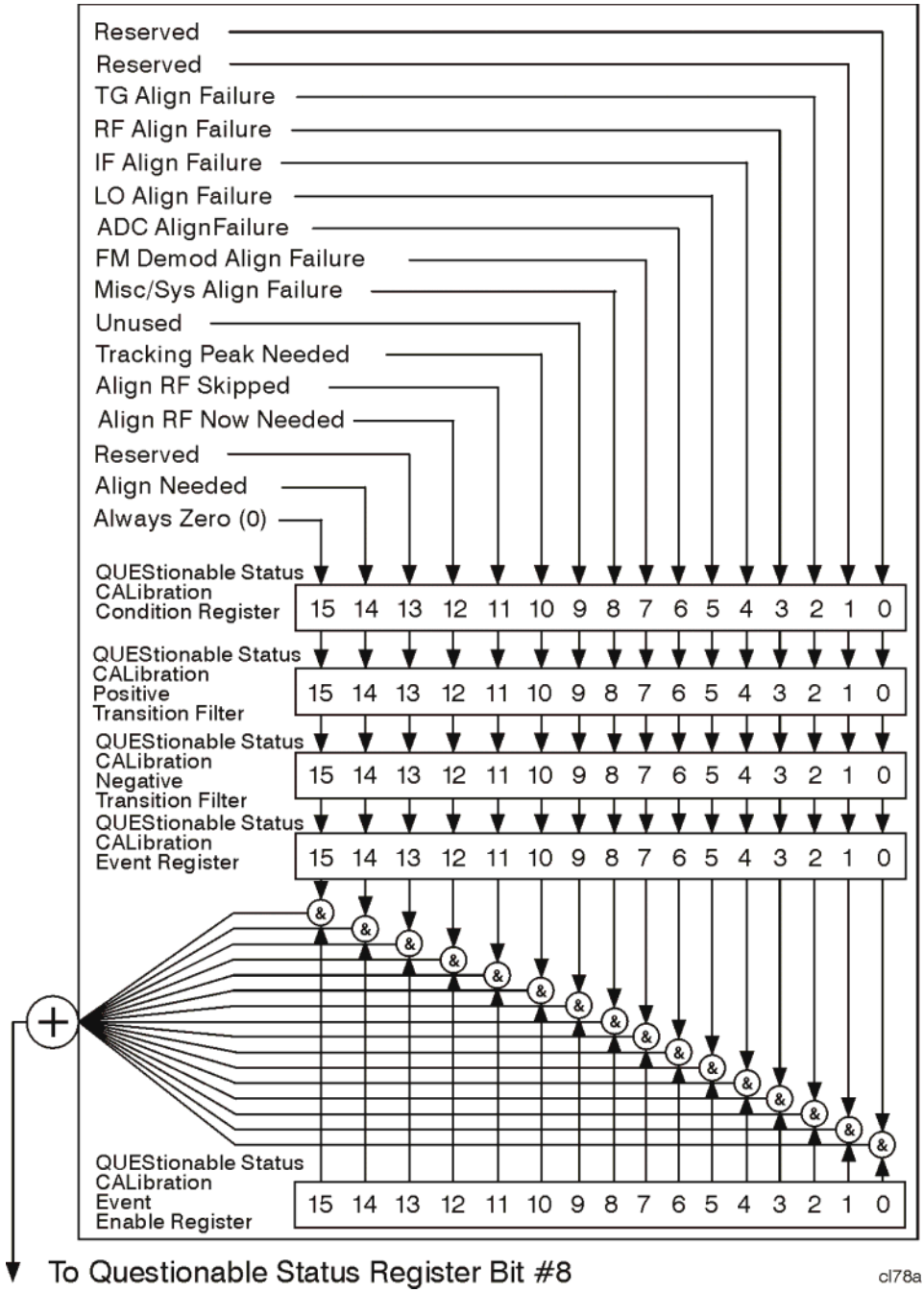
STATus:QUEStionable:CALibration Register

Figure 4-13 Questionable Status Calibration Register Diagram



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Bit descriptions in the Questionable Status Calibration Condition Register are given in the following table.

Bit	Decimal Value	Description
0	0	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
1	2	**Reserved**: This bit is not used by the analyzer, but are for future use with other Agilent products.
2	4	**TG Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the tracking generator (TG).
3	8	**RF Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the RF section.
4	16	**IF Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the IF section.
5	32	**LO Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the local oscillator (LO).
6	64	**ADC Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the analog-to-digital converter (ADC).
7	128	**FM Demod Align Failure**: A 1 in this bit position indicates that a failure has occurred while trying to align the FM demodulation circuitry. (Agilent ESA models E4401B, E4402B, E4404B, E4405B, and E4407B Option BAA, FM Demodulation, only).
8	256	**Misc/Sys Align Failure**: A 1 in this bit position indicates that a digital demodulation RF alignment failure has occurred.
9	512	**Unused**: This bit is always set to 0.
10	1024	**Tracking Peak Needed**: A 1 in this bit position indicates that a tracking peak needs to be performed (the tracking generator is in operation). (Agilent ESA models E4402B, E4403B, E4405B, E4407B, and E4408B, with Option 1DN, Tracking Generator, only).
11	2048	**Align RF Skipped**: A 1 in this bit position indicates that the alignment of the RF section was skipped, perhaps due to an external 50 MHz signal having been detected.
12	4096	**Align RF Now Needed**: A 1 in this bit position indicates that the RF section needs to be aligned.

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Bit	Decimal Value	Description
13	8192	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
14	16384	**Align Needed**: A 1 in this bit position indicates that a full alignment is needed, perhaps due to a large temperature change having been detected with auto align off, or due to default data being used.
15	32768	**Always Zero (0)**: This bit is always set to 0.

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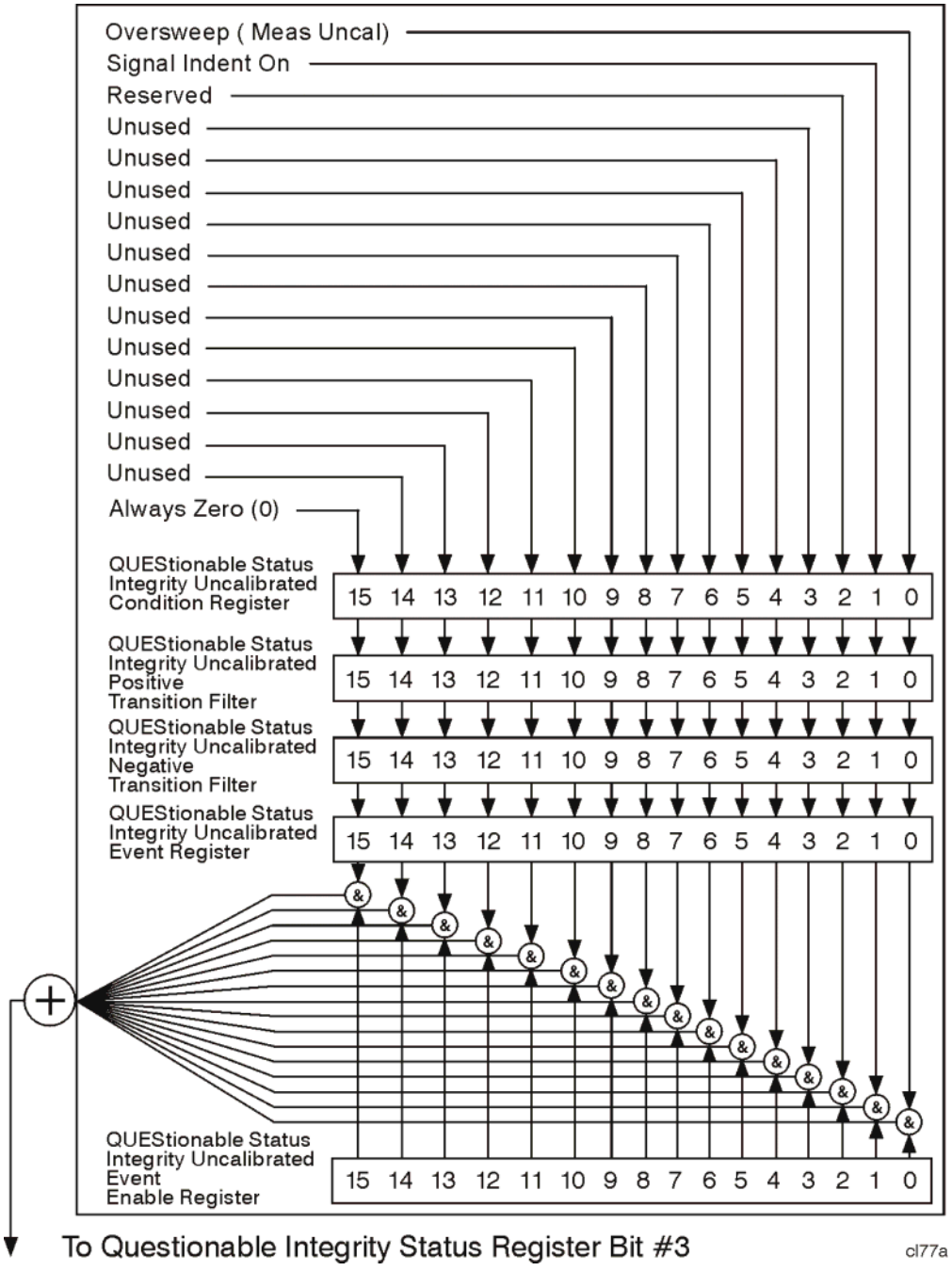
STATus:QUEStionable:INTegrity:UNCalibrated Register

Figure 4-14 Questionable Status Integrity Uncalibrated Register Diagram



Bit descriptions in the Questionable Status Integrity Uncalibrated Condition Register are given in the following table.

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Bit	Decimal Value	Description
0	0	**Oversweep (Meas Uncal)**: A 1 in this position indicates that the analyzer is in a state that could lead to uncalibrated measurements. This is typically caused by sweeping too fast for the current combination of span, resolution bandwidth, and video bandwidth. Auto coupling may resolve this problem.
1	2	**Signal Ident ON**: A 1 in this bit position indicates that amplitude measurements may be in error due to signal identification routines being active. Amplitude accuracy is degraded when signal identification is active. (Agilent ESA model E4407B Option AYZ, External Mixing, only.)
2	4	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
3	8	**Unused**: This bit is always set to 0.
4	16	**Unused**: This bit is always set to 0.
5	32	**Unused**: This bit is always set to 0.
6	64	**Unused**: This bit is always set to 0.
7	128	**Unused**: This bit is always set to 0.
8	256	**Unused**: This bit is always set to 0.
9	512	**Unused**: This bit is always set to 0.
10	1024	**Unused**: This bit is always set to 0.
11	2048	**Unused**: This bit is always set to 0.
12	4096	**Unused**: This bit is always set to 0.
13	8192	**Unused**: This bit is always set to 0.
14	16384	**Unused**: This bit is always set to 0.
15	32768	**Always Zero (0)**: This bit is always set to 0.

Questionable Status Calibration Condition and Event Enable Registers

The Questionable Status Calibration condition register continuously monitors the calibration status of the analyzer. Condition registers are read-only. To query the condition register, send the command `:STATus:QUEStionable:CALibration:CONDition?` The response will be the decimal sum of the bits which are set to 1.

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The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **:STATus:QUEStionable:CALibration:NTRansition <num>** (negative transition) or **:STATus:QUEStionable:CALibration:PTRansition <num>** (positive transition) where **<num>** is the sum of the decimal values of the bits you want to enable.

The Questionable Status Calibration Event register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **:STATus:QUEStionable:CALibration [:EVENt]?**

See "Questionable Status Event Enable Register" on page 212 for an explanation of how to set the summary bit using the event enable register. In this case, use the command **:STATus:QUEStionable:CALibration:ENABle <num>**.

Questionable Status Integrity Uncalibrated Condition and Event Enable Registers

The Questionable Status Integrity Uncalibrated Condition Register continuously monitors the calibration status of the analyzer. Condition registers are read-only. To query the condition register, send the command **:STATus:QUEStionable:INTegrity:UNCalibrated:CONDition?** The response will be the decimal sum of the bits which are set to 1.

The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition <num>** (negative transition) or **:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition <num>** (positive transition) where **<num>** is the sum of the decimal values of the bits you want to enable.

The Questionable Status Integrity Uncalibrated Event Register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **:STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?**

See "Questionable Status Event Enable Register" on page 212 for an explanation of how to set the summary bit using the event enable register. In this case, use the command **:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle <num>**.

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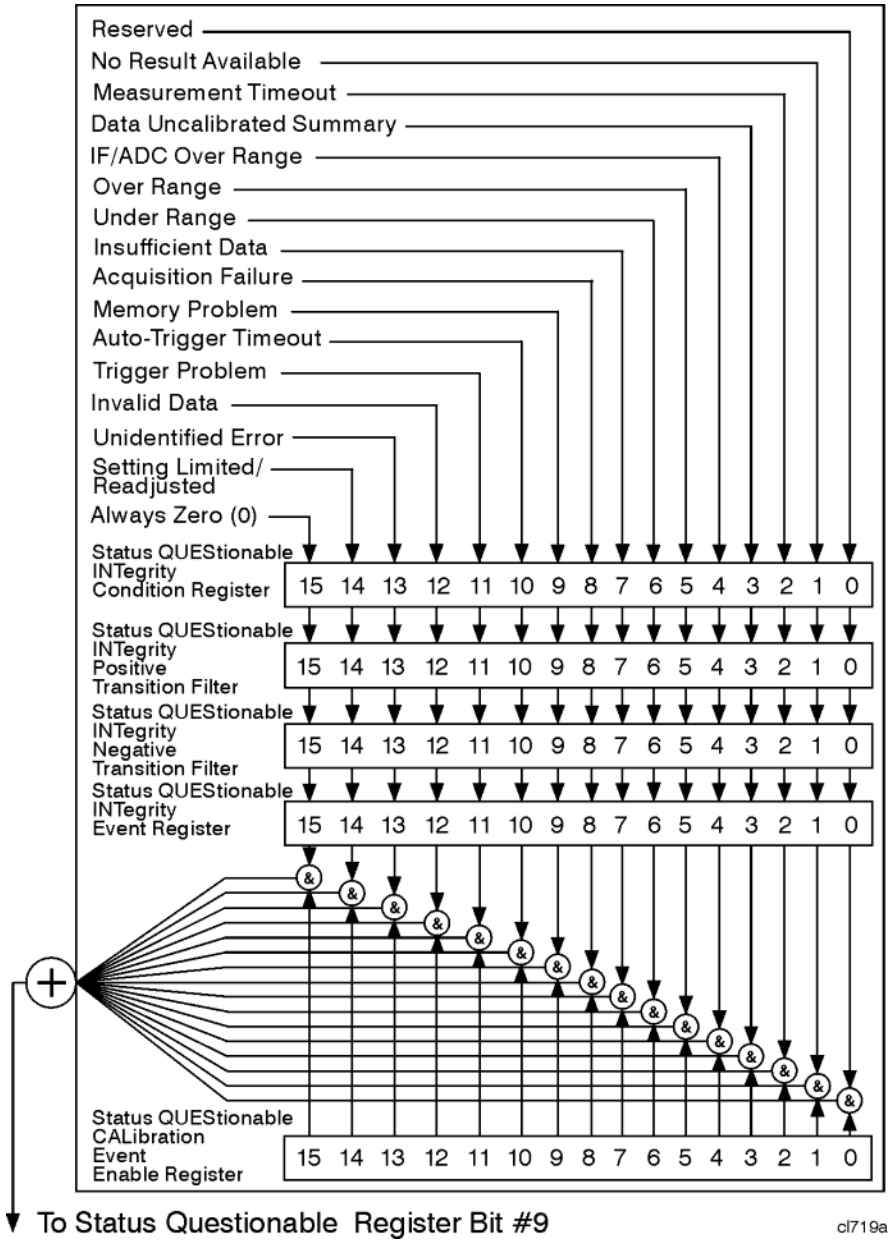
STATus:QUEStionable:INTegrity Register

Figure 4-15 Questionable Status Integrity Register Diagram



Bit descriptions in the Questionable Status Integrity Condition Register are given in the following table.

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Bit	Decimal Value	Description
0	1	**Reserved**: This bit is not used by the analyzer, but is for future use with other Agilent products.
1[a]	2	**No Result Available**: A 1 in this bit position indicates that a measurement terminated with no measurement results.
2[a]	4	**Measurement Timeout**: A 1 in this bit position indicates that a measurement terminated due to a timeout.
3	8	**Data Uncalibrated Summary**: This is the summary bit for the Questionable Status Integrity Uncalibrated Register.
4	16	**IF/ADC Over Range**: The signal input level is too high, causing the analyzer analog-to-digital converter (ADC) range to be exceeded. This may occur with resolution bandwidths less than or equal to 300 Hz in zero span.
5[a]	32	**Over Range**: A 1 in this bit position indicates that the signal is too large at the analog-to-digital converter (ADC).
6[a]	64	**Under Range**: A 1 in this bit position indicates that the signal is too small at the analog-to-digital converter (ADC).
7[a]	128	**Insufficient Data**: A 1 in this bit position indicates that there is not enough information to perform the measurement or function.
8[a]	256	**Acquisition Failure**: A 1 in this bit position indicates that the demod algorithm cannot correlate to the signal.
9[a]	512	**Memory Problem**: A 1 in this bit position indicates a failure of the file system memory or digital signal processor (DSP) memory.
10[a]	1024	**Auto-Trigger Timeout**: A 1 in this bit position indicates that the measurement timed out due to no trigger.
11[a]	2048	**Trigger Problem**: A 1 in this bit position indicates that the measurement timed out due to no trigger.
12	4096	**Invalid Data**: A 1 in this bit position indicates that the present trace data does not reflect the existing analyzer state. Trigger a new sweep and/or measurement.
13[a]	8192	**Unidentified Error**: A 1 in this bit position indicates that a measurement has terminated for a reason other than that given in any of the other bits.

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Bit	Decimal Value	Description
14[a]	16384	**`Setting Limited/Readjusted`**: A 1 in this bit position indicates that the user settings could not be achieved with the existing hardware; values were set to limits.
15	32768	**`Always Zero (0)`**: This bit is always set to 0.

a. This bit applies to ESA optional measurement personalities only, and may or may not be implemented in all such personalities.

Questionable Status Integrity Event Condition and Enable Registers

The Questionable Status Integrity Condition Register continuously monitors the calibration status of the analyzer. Condition registers are read-only. To query the condition register, send the command `:STATus:QUEStionable:INTegrity:CONDition?` The response will be the decimal sum of the bits which are set to 1.

The transition filter specifies which types of bit state changes in the condition register will set corresponding bits in the event register. The changes may be positive (from 0 to 1) or negative (from 1 to 0). Send the command **`:STATus:QUEStionable:INTegrity:NTRansition <num>`** (negative transition) or **`:STATus:QUEStionable:INTegrity:PTRansition <num>`** (positive transition) where **`<num>`** is the sum of the decimal values of the bits you want to enable.

The Questionable Status Integrity Event Register latches transition events from the condition register as specified by the transition filters. Event registers are destructive read-only. Reading data from an event register will clear the content of that register. To query the event register, send the command **`:STATus:QUEStionable:INTegrity[:EVENt]?`**

See "Questionable Status Event Enable Register" on page 212 for an explanation of how to set the summary bit using the event enable register. In this case, use the command **`:STATus:QUEStionable:INTegrity:ENABle <num>`**.

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5 Remote Command Reference

This chapter contains SCPI (Standard Commands for Programmable Instruments) programming commands for the spectrum analyzer core operation. Refer to Volume 2 for the commands associated with the one-button measurements that are available when you press the front-panel **MEASURE** key.

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The first few pages of this chapter contain common commands specified in IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992. Following these commands, the Agilent ESA spectrum analyzers SCPI commands are listed.

NOTE

Chapter 3, “Programming Fundamentals,” on page 175 and Chapter 4 , “Status Registers,” on page 193 supplement the information presented in this chapter.

Refer to Chapter 2 , “Front-Panel Key Reference,” on page 37 in this guide for additional information about the operation of each analyzer function. Use the analyzer HELP key to obtain similar information about analyzer key functions.

Refer to the “Agilent 8590/ESA Spectrum Analyzers Programming Conversion Guide” for specific backwards compatibility information between commands for HP/Agilent 8590-Series spectrum analyzers and Agilent ESA spectrum analyzers.

If you are using an optional programming compatibility modes (for example Option 266), you must refer to the manual that came with the option for command information.

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SCPI Sections and Subsections

SCPI commands related to major functional areas (such as calculate or) are grouped into blocks, or subsystems. Some of these subsystems are further divided into subsections (such as calculate/marker, or sense/harmonics). An instrument model is then created to represent the way in which instrument functionality is viewed and categorized by SCPI. Refer to *IEEE SCPI-1997 Volume 2: Command Reference, Standard Commands for Programmable Instruments*, Version 1997.0, May, 1997 for a more complete description of the SCPI instrument model.

The SCPI subsystems in this chapter are listed in alphabetical order. Likewise, the SCPI commands are in alphabetical order within the subsystem in which they belong. Refer to the following table to locate SCPI command subsystems and subsections by page number.

SCPI Subsystem/Subsection	Page
IEEE Common Commands	page 231
:ABORt	page 236
:CALCulate	page 237
:CALCulate:LLINe	page 239
:CALCulate:MARKer	page 246
:CALCulate:NTData	page 260
:CALibration	page 261
:CONFigure	page 266
:COUPle	page 267
:DISPlay	page 269
:FORMat	page 278
:HCOPy	page 281
:INITiate	page 284
:INPut	page 287
:INSTrument	page 290
:MMEMory	page 293
:OUTPut	page 300
[:SENSe]:	page 301
[:SENSe]:AVERage	page 302

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SCPI Subsystem/Subsection	Page
[:SENSe]:BANDwidth	page 306
[:SENSe]:CORRection	page 309
[:SENSe]:DEMod	page 313
[:SENSe]:DETector	page 316
[:SENSe]:FREQuency	page 321
[:SENSe]:MIXer	page 326
[:SENSe]:POWer	page 329
[:SENSe]:SIDentify	page 332
[:SENSe]:SWEep	page 334
:SOURce	page 343
:STATus	page 349
:STATus:QUEStionable	page 351
:SYSTem	page 361
:TRACe	page 371
:TRIGger	page 378
:UNIT	page 388

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IEEE Common Commands

These commands are specified in IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

Calibration Query

***CAL?**

Performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful. The SCPI equivalent for this command is the same as **:CALibrate[:ALL]?**

NOTE

Before executing this command, connect a cable between front panel connector AMPTD REF OUT and the INPUT connector for all Agilent ESA spectrum analyzers except Agilent models E4401B and E4411B.

If the cable is not connected, **CAL:ALL** will perform a subset of the RF alignment and a subsequent **CAL:RF** will be required for the analyzer to meet its specified performance.

The query performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful, even if only a subset of the RF alignment is performed.

Front Panel Access: **System**, **Alignments**, **Align All Now**

Clear Status

***CLS**

Clears the status byte. It does this by emptying the error queue and clearing all bits in all of the event registers. The status byte registers summarize the states of the other registers. It is also responsible for generating service requests.

Remarks:. See ***STB?**

Standard Event Status Enable

***ESE <number>**

***ESE?**

Sets the bits in the standard event status enable register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, execution error, command error and power on. A summary bit is generated on execution of the command.

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Query returns the state of the standard event status enable register.

Range:. Integer, 0 to 255

Standard Event Status Register Query

***ESR?**

Queries and clears the standard event status event register. (This is a destructive read.)

Range: Integer, 0 to 255

Identification Query

***IDN?**

Returns an instrument identification information string. The string will contain the model number, serial number and firmware revision. The response is organized into four fields separated by commas. The field definitions are as follows:

Manufacturer

Model

Serial number

Firmware version

Example: `Hewlett-Packard, E4401B, US39120213, A.06.00`

NOTE As shown in the example, the analyzer returns “Hewlett-Packard” as the manufacturer even though it is now manufactured by Agilent Technologies. This is intentional. Agilent Technologies was created out of the Hewlett-Packard company, and the Hewlett-Packard name is retained to support those customers who have purchased ESA analyzers in the past.

Front Panel Access: **System, Show System**

Instrument State Query

***LRN?**

Returns current instrument state data in a block of defined length. The information is in a machine readable format only. Sending the query returns the following format:

#PQQQSYST:SET #NMMM<state_data>

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The following example is a response to ***LRN?** The actual sizes will vary depending on the instrument state data size.

Example: `#42031SYST:SET #42016<state data>`

The number 4 (P in the preceding query response format) means there are 4 numbers that make up the size of the data that follows. In this example, 2031 bytes will follow the number 4 (42031).

2031 and 2016 (QQQ and MMM in the preceding query response format) represent data size in bytes.

NOTE The state can be changed by sending this block of data to the instrument after removing the size information:

Example: **`SYST:SET #NMMM<state_data>`**

Operation Complete

`*OPC`

`*OPC?`

Sets bit 0 in the standard event status register to “1” when all pending operations have finished.

The query stops any new commands from being processed until the current processing is complete. Then it returns a “1”, and the program continues. This query can be used to synchronize events of other instruments on the external bus.

`*OPC` and **`*OPC?`** are currently effective only when immediately preceded by either the **`:INITiate:IMMediate`** or a **`:CALibration`** command.

Query Instrument Options

This function is provided in the analyzer SCPI language reference in the SYSTem subsystem under **`:SYSTem:OPTions?`**.

Recall

`*RCL <register>`

This command recalls the instrument state from the specified instrument memory register.

Range: Registers are an integer, 0 to 127

Remarks: See also commands **`:MMEMory:LOAD:STATe`** and

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:**MMEMory:STORe:STATe**

If the state being loaded has a newer firmware revision than the revision of the instrument, no state is recalled and an error is reported.

If the state being loaded has an equal firmware revision than the revision of the instrument, the state will be loaded.

If the state being loaded has an older firmware revision than the revision of the instrument, the instrument will only load the parts of the state that apply to the older revision.

Front Panel Access: **File, Recall State**

Reset

***RST**

This command presets the instrument to a factory defined condition that is appropriate for remote programming operation. ***RST** is equivalent to performing the two commands :**SYSTem:PRESet** and ***CLS**. This command always performs a factory preset.

NOTE The preset performed by ***RST** is always a factory preset. That is, the same preset performed by :**SYSTem:PRESet** when :**SYSTem:PRESet:TYPE** is set to **FACTory**.

Front Panel Access: **Preset**

Save

***SAV <register>**

This command saves the instrument state to the specified instrument memory register.

Range: Registers are an integer, 0 to 127

Remarks: See also commands :**MMEMory:LOAD:STATe** and :**MMEMory:STORe:STATe**

Front Panel Access: **File, Save State**

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Service Request Enable

***SRE <integer>**

***SRE?**

This command sets the value of the service request enable register.

The query returns the value of the register.

Range: Integer, 0 to 255

Read Status Byte Query

***STB?**

Returns the value of the status byte register without erasing its contents.

Remarks: See ***CLS**

Trigger

***TRG**

This command triggers the instrument. Use the **:TRIGger:SEQuence:SOURce** command to select the trigger source.

Remarks: See also the **:INITiate:IMMediate** command

Self Test Query

***TST?**

This query is used by some instruments for a self test.

For Agilent ESA analyzers, ***TST?** always returns 0; no tests are performed.

Front Panel Access: **System, Alignments, Align All Now**

Wait-to-Continue

***WAI**

This command causes the instrument to wait until all pending commands are completed before executing any additional commands. There is no query form to the command.

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ABORt Subsystem

Abort

:ABORt

Restarts any sweep or measurement in progress and resets the sweep or trigger system. A measurement refers to any of the measurements found in the **MEASURE** menu. SCPI commands associated with these measurements are located in Volume 2 *"One-Button Power Measurements"*.

If :**INITiate:CONTinuous** is off (single measure), then :**INITiate:IMMediate** will start a new single measurement.

If :**INITiate:CONTinuous** is on (continuous measure), a new continuous measurement begins immediately.

The INITiate and TRIGger subsystems contain additional related commands.

Front Panel Access: **Restart** for continuous measurement mode

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CALCulate Subsystem

This subsystem is used to perform post-acquisition data processing. In effect, the collection of new data triggers the CALCulate subsystem. In this instrument, the primary functions in this subsystem are markers and limits. CALCulate subsystem commands used for measurements in the **MEASURE** and **Meas Setup** menus are located in Volume 2 *"One-Button Power Measurements"*.

NdBpoints

:CALCulate:BWIDth|BANDwidth:NDB <rel_ampl>

:CALCulate:BWIDth|BANDwidth:NDB?

Selects the power level, below the peak of the signal, at which the signal bandwidth will be measured by the markers.
:**CALCulate:BWIDth|BANDwidth[:STATe]** must be ON.

NOTE

To query the result of NdBpoints, use the command
:CALCulate:BWIDth|BANDwidth:RESult?

Factory Preset and *RST: –3 dB

Range: –80 dB to –1 dB

Default Unit: dB

Remarks: Refer to :**CALCulate:BWIDth|BANDwidth[:STATe]** for an explanation of this marker function.

Front Panel Access: **Peak Search (or Search), N dB Points**

NdBresults

:CALCulate:BWIDth|BANDwidth:RESult?

Returns the measured bandwidth at the power level defined by **:CALCulate:BWIDth:NDB**. –100 is returned if **:CALCulate:BWIDth|BANDwidth[:STATe]** is off, or when a result is not available. Refer to **CALCulate:BWIDth|BANDwidth[:STATe]** for an explanation of this marker function.

Range: Real value less than the current frequency span

Default Unit: Hz

Remarks: When segmented sweep is on, a result will not be available when the NDB marker crosses a segment boundary.

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Front Panel Access: **Peak Search (or Search), N dB Points**

NdBstate

:CALCulate:BWIDth|BANDwidth[:STATe] OFF|ON|0|1

:CALCulate:BWIDth|BANDwidth[:STATe]?

Controls the bandwidth measurement function. The function measures the bandwidth, at the number of dB down specified in **:CALCulate:BWIDth:NDB**, of the maximum signal on the display.

Factory Preset and *RST: Off

Remarks: When this command is turned on, the bandwidth measurement function (N dB Points) is associated with the active marker. If no marker is active at the time this command is turned on, marker 1 becomes the active marker, and a peak search is performed. No restrictions exist for moving the bandwidth measurement function markers to any other signal on the display. However, when this function is turned on, all other concurrent marker functions are suspended.

Front Panel Access: **Peak Search (or Search), N dB Points On Off**

Test Current Trace Data Against all Limit Lines

:CALCulate:CLIMits:FAIL?

Queries the status of the limit line testing. Returns a 0 if the trace data passes when compared with all the current limit lines. Returns a 1 if the trace data fails any limit line test.

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CALCulate:LLINe Subsection

Limit lines can be defined for your measurement. You can then have the instrument compare the data to your defined limits and indicate a pass/fail condition.

NOTE Refer also to **:MMEMory** and **:TRACe** subsystems for more trace and limit line commands.

Delete All Limit Lines in Memory

:CALCulate:LLINe:ALL:DELete

Deletes all limit lines in volatile memory.

History: Added with firmware revision A.08.00.

Front Panel Access: **Display, Limits, Delete All Limits**

Control Limit Line Amplitude Interpolation

:CALCulate:LLINe[1]|2:AMPLitude:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe[1]|2:AMPLitude:INTerpolate:TYPE?

Selects the type of interpolation done for the amplitude values of the designated limit line when comparing to measured data.

Factory Preset and *RST: Not affected by preset

Remarks: Once this function is defined, the selected type is persistent. Persistent means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **Display, Limits, Limit 1|2, Amptd Interp Log Lin**

Set Fixed or Relative Limit Lines

:CALCulate:LLINe:CMODe FIXed|RELative

:CALCulate:LLINe:CMODe?

Specifies whether the current limit lines are fixed or relative.

NOTE If you need to change the domain with :**CALCulate:LLINe:CONTrol:DOMain**, do it before this command. Changing the domain deletes all the existing limit line values.

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Factory Preset and *RST: Not affected by preset

Remarks: For Amplitude Parameters:

Regardless of whether the limit line is based on frequency or sweep time, amplitude parameters in a limit line table represent absolute values or relative values. In fixed, the limit line amplitude values are specified in absolute amplitude and do not depend on the reference level. In relative, the limit line amplitude values are relative to the current reference level.

For Fixed Frequency Parameters:

The frequency values in a limit line table are fixed values, and the limit line is positioned accordingly. Fixed limit lines are specified in absolute frequency and do not depend upon the center frequency values.

For Relative Frequency Parameters:

The frequency values in a limit line table are relative values and positions the limit line relative to the center frequency settings. Relative limit lines are specified in relative frequency and are positioned with respect to the current center frequency. When the current center frequency value is changed, the segment frequencies are converted according to the current center frequency value.

For Time Parameters:

Limit lines that are based on sweep time are always relative to the start time. The horizontal position of the limit line is not affected by this command.

Front Panel Access: **Display, Limits, Limits Fixed Rel**

Set Limit Line X-axis Units

:CALCulate:LLINe:CONTrol:DOMain FREQuency|TIME

:CALCulate:LLINe:CONTrol:DOMain?

Selects how the limit line segments are defined: according to frequency, or according to the sweep time setting of the spectrum analyzer.

NOTE Changing this setting deletes *all* existing limit data from the analyzer. In other words, if a limit line has already been defined, changing the type clears the existing limit line.

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NOTE When using the **:CALCulate:LLINe:CONTrol:DOMain TIME** command, do not use the **:CALCulate:LLINe[1]|2:CONTrol:INTerpolate:TYPE LOGarithmic** command. An error will result because this combination attempts to determine the log of zero, which is undefined.

Factory Preset and *RST: Not affected by Preset

Remarks: For TIME, the limit line segments are placed on the spectrum analyzer display with respect to the sweep time setting of the analyzer, with 0 at the left edge of the display.

For FREQuency, segments are placed according to the frequency that is specified for each segment.

Front Panel Access: **Display, Limits, X Axis Units Freq Time**

Control Limit Line Frequency Interpolation

:CALCulate:LLINe[1]|2:CONTrol:INTerpolate:TYPE LOGarithmic|LINear

:CALCulate:LLINe[1]|2:CONTrol:INTerpolate:TYPE?

Selects the type of interpolation done for the frequency values of the designated limit line when comparing to measured data. This only applies in the frequency domain. This function does not work in zero span (when the analyzer is in the time domain).

Remarks: Once this function is defined, the selected type is persistent. Persistent means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **Display, Limits, Limit 1|2, Freq Interp Log Lin**

Define Limit Line Values

:CALCulate:LLINe[1]|2:DATA <x-axis>,<ampl>,<connected>{,<x-axis>,<ampl>,<connected>}

:CALCulate:LLINe[1]|2:DATA?

Defines limit line values, and destroys all existing data. Up to 200 points may be defined for each limit. No units are allowed.

- <x-axis> – can be frequency or time values as specified by :**CALCulate:LLINe:CONTrol:DOMain**. Frequencies are always in Hz.

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Time is always in seconds. No unit is allowed in this parameter.

- <ampl> – amplitude values are in the current Y-axis units. Up to two amplitude values can be provided for each x-axis value, by repeating <x-axis> in the data list. No unit is allowed in this parameter.
- <connected> – connected values are either 0 or 1. A 1 means this point should be connected to the previously defined point to define the limit line. A 0 means that it is a point of discontinuity and is not connected to the preceding point. The "connected" value is ignored for the first point.

Example: **CALC:LLIN1:DATA 1000000000,-20,0,200000000,-30,1**

Range: **<x-axis>** –30 Gs to +30 Gs for time limits

<x-axis> –30 GHz to +350 GHz for frequency limits

<ampl> –120 dBm to +100 dBm

<connected> 0 or 1

Remarks: If two amplitude values are entered for the same frequency, a single vertical line is the result. In this case, if an upper line is chosen, the amplitude of lesser frequency (amplitude 1) is tested. If a lower line is chosen, the amplitude of greater frequency (amplitude 2) is tested.

For linear amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{f_{i+1} - f_i}(f - f_i) + y_i$$

For linear amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$y = \frac{y_{i+1} - y_i}{\log f_{i+1} - \log f_i}(\log f - \log f_i) + y_i$$

For log amplitude interpolation and linear frequency interpolation, the interpolation is computed as:

$$\log y = \frac{\log y_{i+1} - \log y_i}{f_{i+1} - f_i}(f - f_i) + \log y_i$$

For log amplitude interpolation and log frequency interpolation, the interpolation is computed as:

$$\log y = \frac{\log y_{i+1} - \log y_i}{\log f_{i+1} - \log f_i}(\log f - \log f_i) + \log y_i$$

Front Panel Access: **Display, Limits, X Axis Units Freq Time**

Display, Limits, Limit 1|2, Edit

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Display, Limits, Limit 1|2, Edit, Point

Display, Limits, Limit 1|2, Edit, Frequency

Display, Limits, Limit 1|2, Edit, Amplitude

Display, Limits, Limit 1|2, Edit, Connected

Display, Limits, Limit 1|2, Edit, Delete Point

Merge Additional Values into the Existing Limit Line

:CALCulate:LLINe[1]|2:DATA:MERGe
<x-axis>,<ampl>,<connected>{,<x-axis>,<ampl>,<connected>}

Adds the points with the specified values to the current limit line, allowing you to merge limit line data. Up to two amplitude values are allowed for each x value. If too much data is merged, as many points as possible are merged into the existing limit and then an error is reported. Up to 200 points total may be defined for each limit.

- <x-axis> can be frequency or time values as specified by **:CALCulate:LLINe:CONTrol:DOMain**. Frequencies are always in Hz. Time is always in seconds. No unit is allowed in this parameter.
- <ampl> – amplitude values are in the current Y-axis units. No unit is allowed in this parameter.
- <connected> connected values are either 0 or 1. A 1 means this point should be connected to the previously defined point to define the limit line. A 0 means that it is a point of discontinuity and is not connected to the preceding point. The “connected” value is ignored for the first point.

Range: <x-axis> –30 Gs to +30 Gs for time limits

<x-axis> –30 GHz to +350 GHz for frequency limits

<ampl> –120 dBm to +100 dBm

<connected> 0 or 1

Front Panel Access: **Display, Limits, X Axis Units Freq Time**

Delete Limit Line

:CALCulate:LLINe[1]|2:DELete

Deletes the selected limit line.

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Display the Limit Line

:CALCulate:LLINe[1]|2:DISPlay OFF|ON|0|1

:CALCulate:LLINe[1]|2:DISPlay?

Controls the display of the current limit line.

Factory Preset and *RST: Off

Front Panel Access: **Display, Limits, Limit 1|2, Limit On Off**

Test the Data Against the Limit Line

:CALCulate:LLINe[1]|2:FAIL?

Queries the status of the limit line testing. Returns a 0 if the data passes, and returns a 1 if there is a failure. This query value is valid only if margin or limit test is On. Use the command **:CALCulate:LLINe[1]|2:STATe OFF|ON|0|1** to activate limit line testing.

Set the Margin Size

:CALCulate:LLINe[1]|2:MARGin <rel_ampl>

:CALCulate:LLINe[1]|2:MARGin?

Allows you to define the amount of measurement margin that is added to the designated limit line.

Factory Preset and *RST: not affected

Default Units: dB

Remarks: The margin must be negative for upper limit lines, and positive for lower limits.

Front Panel Access: **Display, Limits, Limit 1|2, Margin On Off**

Display the Limit Margin

:CALCulate:LLINe[1]|2:MARGin:STATe OFF|ON|0|1

:CALCulate:LLINe[1]|2:MARGin:STATe?

Allows you to display a measurement margin that is added to the designated limit line to do secondary testing of the data.

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Factory Preset and *RST: Off

Front Panel Access: **Display, Limits, Limit 1|2, Margin On Off**

Control Limit Line Testing

:CALCulate:LLINe[1]|2:STATe OFF|ON|0|1

:CALCulate:LLINe[1]|2:STATe?

Turns limit line testing on/off. The limit and margin will only be tested if they are displayed. Use :**CALCulate:LLINe[1]|2:DISPlay** to turn on the display of limit lines, and :**CALCulate:LLINe[1]|2:MARGin:STATe** to turn on the display of margins. If margin and limit display are both turned off, limit test is automatically turned off. Use :**CALCulate:LLINe[1]|2:FAIL?** to return the state of pass or fail after limit line state has been turned on.

Factory Preset and *RST: Off

Front Panel Access: **Display, Limits, Limit 1|2, Limit On Off**

Select the Type of Limit Line

:CALCulate:LLINe[1]|2:TYPE UPPer|LOWer

:CALCulate:LLINe[1]|2:TYPE?

Sets a limit line to be either an upper or lower type limit line. An upper line will be used as the maximum allowable value when comparing with the data. A lower limit line defines the minimum value.

Factory Preset and *RST: Upper; not affected by preset

Remarks: If a margin has already been set for this limit line, and this command is used to change the limit type, then the margin value is reset to 0 dB.

Front Panel Access: **Display, Limits, Limit 1|2, Type Upper Lower**

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CALCulate:MARKer Subsection

Markers All Off on All Traces

:CALCulate:MARKer:AOFF

Turns off all markers on all the traces.

Front Panel Access: **Marker, Marker All Off**

Continuous Peaking Marker Function

:CALCulate:MARKer[1]|2|3|4:CPEak[:STATe] OFF|ON|0|1

:CALCulate:MARKer[1]|2|3|4:CPEak[:STATe]?

Turns on or off continuous peaking. It continuously puts the selected marker on the highest displayed signal peak. Refer to "Continuous Pk On Off" on page 116 for more information.

NOTE This function is intended to maintain the marker on signals with a frequency that is changing, and an amplitude that is not changing.

Factory Preset and *RST: Off

Remarks: This command may not be used to activate a given marker.

Front Panel Access: **Peak Search (or Search), Continuous Pk On Off**

Frequency Counter Marker Resolution

:CALCulate:MARKer:FCOunt:RESolution <real>

:CALCulate:MARKer:FCOunt:RESolution?

Sets the resolution of the marker frequency counter. Setting the resolution to AUTO will couple the marker counter resolution to the frequency span.

Factory Preset and *RST: 1 kHz

Range: 1 Hz to 100 kHz

Default Unit: Hz

Front Panel

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Access: **Freq Count, Resolution Auto Man**

Frequency Counter Marker Automatic Resolution

:CALCulate:MARKer:FCOunt:RESolution:AUTO OFF|ON|0|1

:CALCulate:MARKer:FCOunt:RESolution:AUTO?

Sets the resolution of the marker frequency counter so it is automatically coupled to the frequency span, generating the fastest accurate count.

Factory Preset and *RST: On

Front Panel Access: **Freq Count, Resolution Auto Man**

Frequency Counter Marker

:CALCulate:MARKer[1]|2|3|4:FCOunt[:STATe] OFF|ON|0|1

:CALCulate:MARKer[1]|2|3|4:FCOunt[:STATe]?

Turns on or off the marker frequency counter. To query the frequency counter, use **:CALCulate:MARKer[1]:FCOunt:X?** If the specified marker number is not the active marker, it becomes the active marker. If the specified marker number is not on, it is turned on and becomes the active marker. Once the marker count is on, it is on for any active marker, not just for the one used in the command. A 1 is returned only if marker count is on and the selected number is the active marker.

Factory Preset and *RST: Off

Remarks: If a frequency count x value is generated when the frequency count state is off, then 9e15 is returned.

Front Panel Access: **Freq Count, Marker Count On Off**

Frequency Counter Marker Query

:CALCulate:MARKer[1]|2|3|4:FCOunt:X?

Queries the marker frequency counter.

Remarks: If a frequency count x value is generated when the frequency count state is off, then 9e15 is returned.

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Marker Function

:CALCulate:MARKer[1]|2|3|4:FUNCtion BPOWer|NOISe|OFF

:CALCulate:MARKer[1]|2|3|4:FUNCtion?

Selects the marker function for the specified marker. To query the value returned by the function, use :CALCulate:MARKer[1]|2|3|4:Y?

BPOWer is the power integrated within the bandwidth

NOISe is a noise measurement

OFF turns off all functions

Remarks: When a measurement under the front panel **MEASURE** key is started, this command is turned off. If this command is turned on when any of the **MEASURE** key measurements are in progress, that measurement will be stopped.

Front Panel Access: **Marker, Function**

Marker Peak (Maximum) Search

:CALCulate:MARKer[1]|2|3|4:MAXimum

Performs a peak search based on the search mode settings of **:CALCulate:MARKer:PEAK:SEARch:MODE**.

NOTE See command **:CALCulate:MARKer:PEAK:SEARch:MODE**

Front Panel Access: **Peak Search (or Search), Meas Tools**, **Peak Search**

Marker Peak (Maximum) Left Search

:CALCulate:MARKer[1]|2|3|4:MAXimum:LEFT

Places the selected marker on the next highest signal peak to the left of the current marked peak.

Remarks: The marker will be placed at the next highest peak that rises and falls by at least the peak excursion above the peak threshold. If no peak meets the excursion and threshold criteria, a No Peak Found error (202) is given.

Front Panel Access: **Peak Search (or Search), Next Pk Left**

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Marker Next Peak (Maximum) Search

:CALCulate:MARKer[1]|2|3|4:MAXimum:NEXT

Places the selected marker on the next highest signal peak from the current marked peak.

Remarks: The marker will be placed at the highest peak that rises and falls by at least the peak excursion above the peak threshold. If no peak meets the excursion and threshold criteria, a No Peak Found error (202) is given.

Front Panel Access: **Peak Search (or Search), Next Peak**

Marker Peak (Maximum) Right Search

:CALCulate:MARKer[1]|2|3|4:MAXimum:RIGHt

Places the selected marker on the next highest signal peak to the right of the current marked peak.

Remarks: The marker will be placed at the highest peak that rises and falls by at least the peak excursion above the peak threshold. If no peak meets the excursion and threshold criteria, a No Peak Found error (202) is given.

Front Panel Access: **Peak Search (or Search), Next Pk Right**

Marker Peak (Minimum) Search

:CALCulate:MARKer[1]|2|3|4:MINimum

Places the selected marker on the lowest point on the trace that is assigned to that particular marker number.

Front Panel Access: **Peak Search (or Search), Min Search**

Marker Mode

:CALCulate:MARKer[1]|2|3|4:MODE POSition|DELTa|BAND|SPAN

:CALCulate:MARKer[1]|2|3|4:MODE?

Selects the type of markers that you want to activate. Refer to "Marker" on page 105 for a more complete explanation of this function.

Position selects a normal marker that can be positioned on a trace and from

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which trace information will be generated.

Delta activates a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

Band activates a pair of band markers, where each marker can be independently positioned on the trace. The marker readout shows the difference between the two markers. The repeatability of your band power marker measurement can be impacted by the current number of sweep points being used. If you only have a few sweep points in the measurement band of interest, then small changes will have a direct impact on the measurement result. Increasing your number of sweep points will decrease that affect and improve the repeatability.

Span activates a pair of span markers, where the marker positioning is controlled by changing the span and/or center frequency between the two markers. The marker readout shows the difference between the two markers.

Remarks: If a marker is not active when the mode is queried, “Off” will be returned.

Front Panel Access: **Marker, Normal**

Marker, Delta

Marker, Delta Pair Ref Delta

Marker, Span Pair Span Center

Define Peak Excursion

`:CALCulate:MARKer:PEAK:EXCursion <rel_ampl>`

`:CALCulate:MARKer:PEAK:EXCursion?`

Specifies the minimum signal excursion above the threshold for the internal peak identification routine to recognize a signal as a peak. This applies to all traces and all windows. (The excursion is the delta power from the noise level to the signal peak.)

NOTE See command **`:CALCulate:MARKer:PEAK:SEARch:MODE`**

Factory Preset and *RST: 6 dB

Range: 0 to 100 dB

Default Unit: dB

Front Panel Access: **Peak Search (or Search), Search Criteria, Peak Excursion**

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Define Peak Search

:CALCulate:MARKer:PEAK:SEARch:MODE PARameter|MAXimum

:CALCulate:MARKer:PEAK:SEARch:MODE?

Sets the peak search mode.

Factory Preset and *RST: MAXimum

Remarks: If mode is set to MAXimum, peak search will place the marker at the maximum amplitude in the trace. If mode is set to PARameter, peak search will place the marker at the highest peak that rises and falls by at least the peak excursion above the peak threshold. If no peak meets the excursion and threshold criteria, a No Peak Found error (error 202) is issued.

Next peak, next peak right, next peak left, and peak table are not affected by this command. They will always use peak excursion and peak threshold for search criteria.

Front Panel Access: **Peak Search (or Search), Search Criteria, Peak Search Type, Max Value|Excursion & Threshold**

Define Peak Threshold

:CALCulate:MARKer:PEAK:THReshold <ampl>

:CALCulate:MARKer:PEAK:THReshold?

Specifies the minimum signal level for the analyzers internal peak identification routine to recognize a signal as a peak. This applies to all traces and all windows.

NOTE See command **:CALCulate:MARKer:PEAK:SEARch:MODE**

Range: Reference level to the bottom of the display

Default Unit: Amplitude units

Front Panel Access: **Peak Search (or Search), Search Criteria, Peak Threshold**

Peak to Peak Delta Markers

:CALCulate:MARKer[1]|2|3|4:PTPeak

Positions delta markers on the highest and lowest points on the trace.

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Factory Preset and *RST: Off

Front Panel Access: **Peak Search (or Search), Pk-Pk Search**

Set Center Frequency to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:CENTer

Sets the center frequency equal to the specified marker frequency, which moves the marker to the center of the screen. In delta marker mode, the center frequency is set to the marker delta value. This command is not available in zero span.

Front Panel Access: **Marker –>, Mkr –> CF**

Set Reference Level to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:RLEVel

Sets the reference level to the specified marker amplitude. In delta marker mode, the reference level is set to the amplitude difference between the markers.

Front Panel Access: **Marker –>, Mkr –> Ref Lvl**

Peak Search (or Search), Meas Tools, Mkr –> Ref Lvl

Set Span to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:SPAN

Sets the span to the value of the specified marker frequency. The specified marker must be in delta mode. Select the delta marker mode with **CALCulate:MARKer[1]|2|3|4:MODE DELTa**. This command is not available in zero span.

Front Panel Access: **Marker, Delta, Marker –>, Mkr Δ –> Span**

Set Start Frequency to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:STARt

Sets the start frequency to the value of the specified marker frequency. In delta marker mode, the start frequency is set to the marker delta value. This command is

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not available in zero span.

Front Panel Access: **Marker –>, Mkr –> Start**

Set Center Frequency Step Size to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:STEP

Sets the center frequency step size to match the marker frequency. In delta marker mode, the center frequency step size will be set to the frequency difference between the markers. Select the delta marker mode with **:CALCulate:MARKer[1]|2|3|4:MODE DELTa**. This command is not available if the delta marker is off, or in zero span.

Front Panel Access: **Marker –>, Mkr –> CF Step**

Peak Search (or Search), Meas Tools, Mkr –> CF

Set Stop Frequency to the Marker Value

:CALCulate:MARKer[1]|2|3|4[:SET]:STOP

Sets the stop frequency to the value of the active marker frequency. In delta marker mode, the stop frequency is set to the marker delta value. This command is not available in zero span.

Front Panel Access: **Marker –>, Mkr –> Stop**

Marker On/Off

:CALCulate:MARKer[1]|2|3|4:STATe OFF|ON|0|1

:CALCulate:MARKer[1]|2|3|4:STATe?

Turns the selected marker on or off.

Front Panel Access: **Marker, Off**

Marker Table On/Off

:CALCulate:MARKer:TABLe:STATe OFF|ON|0|1

:CALCulate:MARKer:TABLe:STATe?

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Turns the marker table on or off

Front Panel Access: **Marker, Marker Table On Off**

Marker to Trace

:CALCulate:MARKer[1]|2|3|4:TRACe <integer>

:CALCulate:MARKer[1]|2|3|4:TRACe?

Assigns the specified marker to the designated trace 1, 2, or 3.

Factory Preset and *RST: 1

Range: 1 to 3

Front Panel Access: **Marker, Marker Trace Auto 1 2 3**

Marker to Trace Auto

:CALCulate:MARKer[1]|2|3|4:TRACe:AUTO OFF|ON|0|1

:CALCulate:MARKer[1]|2|3|4:TRACe:AUTO?

Turns on or off the automatic marker to trace function.

Factory Preset and *RST: **AUTO ON**

Front Panel Access: **Marker, Marker Trace Auto 1 2 3**

Continuous Signal Tracking Function

:CALCulate:MARKer[1]|2|3|4:TRCKing[:STATe] OFF|ON|0|1

:CALCulate:MARKer[1]|2|3|4:TRCKing[:STATe]?

Turns on or off marker signal tracking. It continuously puts the selected marker on the highest displayed signal peak and moves it to the center frequency. This allows you to keep a signal that is drifting in frequency, on the display.

Factory Preset and *RST: Off

Remarks: When a measurement under the front panel **MEASURE** key is started, this command is turned off. If this command is turned on when any of the **MEASURE** key measurements are in

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progress, that measurement will be stopped.

Front Panel Access: **FREQUENCY/Channel, Signal Track On Off**

Marker X Value

:CALCulate:MARKer[1]|2|3|4:X <param>

:CALCulate:MARKer[1]|2|3|4:X?

Position the designated marker on its assigned trace at the specified trace X value. The value is in the X-axis units (which is often frequency or time). If the marker is a delta marker this command sets the value of the delta marker.

The query returns the current X value of the designated marker.

Default Unit: Matches the units of the trace on which the marker is positioned

Front Panel Access: **Marker**

Span Markers Center Frequency X Value

:CALCulate:MARKer[1]|2|3|4:X:CENTer <param>

:CALCulate:MARKer[1]|2|3|4:X:CENTer?

Position the center frequency, of the designated span-type marker pair, at the specified trace X value. The value is in the X-axis units (which is often frequency or time) Use :**CALCulate:MARKer:MODE SPAN** to select span markers.

The query returns the current X value center frequency of the designated markers.

Range: Matches the units of the trace on which the markers are positioned

Front Panel Access: **Marker, <active marker>, Span Pair**

Marker X Position

:CALCulate:MARKer[1]|2|3|4:X:POSition <integer>

:CALCulate:MARKer[1]|2|3|4:X:POSition?

Position the designated marker on its assigned trace at the specified X position.

The query returns the current X position for the designated marker.

Range: Refer to the [:**SENSe]:SWEep:POINts** command.

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Front Panel Access: **Marker**

Span Markers Center Frequency X Position

:CALCulate:MARKer[1]|2|3|4:X:POSition:CENTer <param>

:CALCulate:MARKer[1]|2|3|4:X:POSition:CENTer?

Position the center frequency, of the designated span-type marker pair, at the specified trace X position. Use **:CALCulate:MARKer:MODE SPAN** to select span markers.

The query returns the current X position center frequency of the designated markers.

Range: Refer to the **[:SENSe]:SWEep:POINts** command.

Front Panel Access: **Marker, <active marker>, Span Pair**

Span Markers Span X Position

:CALCulate:MARKer[1]|2|3|4:X:POSition:SPAN <param>

:CALCulate:MARKer[1]|2|3|4:X:POSition:SPAN?

Change the frequency span, of the designated span-type marker pair, to position the markers at the desired trace X positions. Use **:CALCulate:MARKer:MODE SPAN** to select span markers.

The query returns the current X position frequency span of the designated markers.

Range: Refer to the **[:SENSe]:SWEep:POINts** command.

Front Panel Access: **Marker, <active marker>, Span Pair**

Delta Pair Markers Start Frequency X Position

:CALCulate:MARKer[1]|2|3|4:X:POSition:STARt <param>

:CALCulate:MARKer[1]|2|3|4:X:POSition:STARt?

Position the left-most marker, the start (reference) frequency of the designated band-type marker pair, at the specified trace X position. Use **:CALCulate:MARKer:MODE BAND** to select band markers.

The query returns the current X position start/reference frequency of the

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designated marker.

Range: Refer to the [:**SENSe]:SWEep:POINts** command.

Front Panel Access: **Marker, <active marker>, Delta Pair**

Delta Pair Markers Stop Frequency X Position

:CALCulate:MARKer[1]|2|3|4:X:POSition:STOP <param>

:CALCulate:MARKer[1]|2|3|4:X:POSition:STOP?

Position the right-most marker, the stop frequency of the designated band-type marker pair, at the specified trace X position. Use :**CALCulate:MARKer:MODE BAND** to select band markers.

The query returns the current X position stop frequency of the designated marker.

Range: Refer to the [:**SENSe]:SWEep:POINts** command.

Front Panel Access: **Marker, <active marker>, Delta**

Marker X-Axis Readout

:CALCulate:MARKer[1]|2|3|4:X:READout FREQuency|TIME|ITIMe|PERiod

:CALCulate:MARKer[1]|2|3|4:X:READout?

Selects the units for the x-axis readout of the marker. Available units are:

Frequency
Time
Inverse of time
Period

Factory Preset and *RST: Frequency

Front Panel Access: **Marker, Readout, Frequency**

Marker, Readout, Time

Marker, Readout, Inverse Time

Marker, Readout, Period

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Span Markers Span X Value

:CALCulate:MARKer[1]|2|3|4:X:SPAN <param>

:CALCulate:MARKer[1]|2|3|4:X:SPAN?

Change the frequency span of the designated span-type marker pair to position the markers at the desired trace X values. The value is in the X-axis units (which is usually frequency or time). Use **:CALCulate:MARKer:MODE SPAN** to select span markers.

The query returns the current X value frequency span of the designated markers. If span markers are not selected, the query returns the latest marker reading as a span (always positive).

Default Unit: Matches the units of the trace on which the markers are positioned.

Front Panel Access: **Marker, <active marker>, Span Pair**

Delta Pair Markers Start Frequency X Value

:CALCulate:MARKer[1]|2|3|4:X:STARt <param>

:CALCulate:MARKer[1]|2|3|4:X:STARt?

Position the start (reference) frequency of the designated band-type marker pair, at the specified trace X value. The value is in the X-axis units (which is often frequency or time). Use **:CALCulate:MARKer:MODE BAND** to select band markers.

The query returns the current X value start/reference frequency of the designated marker.

Default Unit: Matches the units of the trace on which the markers are positioned

Front Panel Access: **Marker, <active marker>, Delta Pair**

Delta Pair Markers Stop Frequency X Value

:CALCulate:MARKer[1]|2|3|4:X:STOP <param>

:CALCulate:MARKer[1]|2|3|4:X:STOP?

Position the stop frequency of the designated band-type marker pair, at the specified trace X value. The value is in the X-axis units (which is often frequency or time). Use **:CALCulate:MARKer:MODE BAND** to select band markers.

The query returns the current X value stop frequency of the designated marker.

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Default Unit: Matches the units of the trace on which the markers are positioned

Front Panel Access: **Marker, <active marker>, Delta Pair**

Marker Read Y Value

`:CALCulate:MARKer[1]|2|3|4:Y?`

Read the current Y value for the designated marker or delta on its assigned trace. The value is in the Y-axis units for the current trace (which is often dBm).

Default Unit:. Matches the units of the trace on which the marker is positioned

Remarks:. This command can be used to read the results of marker functions such as band power and noise that are displayed in the marker value field on the analyzer.

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CALCulate:NTData Subsection

Normalize the Trace Data

:CALCulate:NTData[:STATe] OFF|ON|0|1

:CALCulate:NTData[:STATe]?

One sweep of trace data is copied to trace 3 (firmware version greater then A.03.03, **NRML** in firmware version less than or equal to A.03.03), which is used as the reference trace. Then for all subsequent trace sweeps, display trace 1 = data collected into trace 1 – data in trace 3 (firmware version greater than A.03.03, NRML in firmware version less than or equal to A.03.03).

Front Panel Access: **View/Trace, Normalize, Normalize On Off**

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CALibration Subsystem

These commands control the self-alignment and self-diagnostic processes.

Align All Instrument Assemblies

:CALibration[:ALL]

:CALibration[:ALL]?

Performs an alignment of all the assemblies within the instrument, except for the tracking generator (Option 1DN or 1DQ), if installed (except Agilent model E4401B or E4411B.

Before executing this command, connect a cable between front panel connector **AMPTD REF OUT** and the **INPUT** connector for all Agilent ESA spectrum analyzers except Agilent models E4401B and E4411B.

If the cable is not connected, **CAL:ALL** will perform a subset of the RF alignment and a subsequent **CAL:RF** will be required for the analyzer to meet its specified performance.

The query performs a full alignment and returns a number indicating the success of the alignment. A zero is returned if the alignment is successful, even if only a subset of the RF alignment is performed.

Front Panel Access: **System, Alignments, Align Now, All**

Set Auto Align Mode All or Not RF

:CALibration:AUTO:MODE ALL|NRF

:CALibration:AUTO:MODE?

This command determines whether or not to include RF alignment as part of the automatic alignment routines. Eliminating automatic alignment of the RF prevents changes in the input impedance between sweeps, which could cause input device instability.

Factory Preset and *RST: All at power-up

Front Panel Access: **System, Alignments, Auto Align, All**

System, Alignments, Auto Align, All but RF

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Automatic Alignment

:CALibration:AUTO OFF|ON|0|1

:CALibration:AUTO?

Turns the automatic alignment on and off. This is run continuously, at the completion of each sweep.

Factory Preset and *RST: On at power-up

Front Panel Access: **System, Alignments, Auto Align, All**

System, Alignments, Auto Align, All but RF

System, Alignments, Auto Align, Off

Return to the Default Alignment Data

:CALibration:DATA:DEFault

Initializes the alignment data to the factory defaults.

Front Panel Access: **System, Alignments, Load Defaults**

Align FM Demodulation

:CALibration:FMDemod

:CALibration:FMDemod?

Performs an alignment of the FM demodulation hardware if Option 106, AYQ or BAA is installed. The query form of this command performs the alignment and returns zero if the alignment is successful. If you have multiple FM demodulation hardware options, the hardware that will be used is automatically selected in order of priority (with firmware revisions A.14.00 or later).

1. Option 106 - Bluetooth™ [1]
2. Option AYQ - Quasi-peak detection and FM demodulation
3. Option BAA - FM Demodulation

Front Panel Access: **System, Alignments, Align Now, FM Demod**

1. Bluetooth is a trademark owned by its proprietor and used by Agilent Technologies under license.

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Query the Internal or External Frequency Reference

:CALibration:FREQuency:REFerence?

This is a query only. It reports the location of where the instrument frequency reference is generated.

Range: INT or EXT

Coarse Adjust the Frequency Reference

:CALibration:FREQuency:REFerence:COARse <setting>

:CALibration:FREQuency:REFerence:COARse?

Allows coarse adjustment of the internal 10 MHz reference oscillator timebase of the analyzer.

NOTE **:CALibration:ALL** is required after **COARse** is set.

Range: Integer, 0 to 255

Front Panel Access: **System, Alignments, Time Base, Coarse**

Fine Adjust the Frequency Reference

:CALibration:FREQuency:REFerence:FINE <setting>

:CALibration:FREQuency:REFerence:FINE?

Allows fine adjustment of the analyzer internal 10 MHz reference oscillator timebase.

NOTE **:CALibration:ALL** is required after **FINE** is set.

Range: Integer, 0 to 255

Front Panel Access: **System, Alignments, Time Base, Fine**

Select the Frequency Corrections

:CALibration:FREQuency[:STATe] OFF|ON|0|1

:CALibration:FREQuency[:STATe]?

Turns on or off the frequency corrections.

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Factory Preset and *RST: On

Front Panel Access: **System, Alignments, Freq Correct On Off**

Align the RF Circuitry

:CALibration:RF

:CALibration:RF?

Performs an alignment of the RF assembly.

The query performs the alignment and returns a zero if the alignment is successful.

Before executing this command, connect a cable between front panel connector **AMPTD REF OUT** and the **INPUT** connector for all Agilent ESA spectrum analyzers except Agilent models E4401B and E4411B. If the cable is not connected, the alignment will fail.

Front Panel Access: **System, Alignments, Align Now, RF**

Select the Source State for Calibration

:CALibration:SOURce:STATe OFF|ON|0|1

:CALibration:SOURce:STATe?

Controls the state of the 50 MHz alignment signal.

NOTE The alignment signal is internally switched to the **INPUT** for Agilent models E4401B and E4411B. For all other models, connect a cable between front panel connector **AMPTD REF OUT** and the **INPUT** connector before performing a calibration.

Factory Preset and *RST: Off

Front Panel Access: For Agilent ESA models E4401B and E4411B:

Input/Output (or Input), Amptd Ref (f=50 MHz) On Off

For all other Agilent ESA models:

Input/Output (or Input), Amptd Ref Out (f=50 MHz) On Off

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Calibrate the Tracking Generator

`:CALibration:TG`

`:CALibration:TG?`

Performs an alignment of the tracking generator assembly.

The query performs the alignment and returns a zero if the alignment is successful.

NOTE This command is only applicable on Agilent ESA models E4402B, E4403B, E4404B, E4405B, E4407B, and E4408B. Before executing this command, connect a cable between front panel connector **RF OUT** and the **INPUT** connector. The alignment will fail using command **`CAL:TG`** if the cable is not connected.

Front Panel Access: **System, Alignments, Align Now, TG**

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CONFigure Subsystem

Configure the Basic Spectrum Analyzer State

`:CONFigure:SANalyzer`

This command causes the present measurement to exit (the same functionally as pressing **MEASURE, Meas Off**), and places the analyzer in base instrument spectrum analyzer state. CONFigure subsystem commands used for measurements in the **MEASURE** and **Meas Setup** menus are located in Volume 2 *"One-Button Power Measurements"*.

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COUPle Subsystem

Some measurement settings are automatically coupled together to optimize speed and accuracy. These commands control that coupling.

COUPle the Function to Other Settings

:COUPle ALL|NONE

:COUPle?

The instrument can automatically couple instrument settings together for accurate measurements and optimum dynamic range. This command is used to override the coupling for special measurement needs.

COUPle NONE puts these functions into the manually set (not coupled) mode. **COUPle ALL** puts the functions into the auto coupled mode, and also puts the sweep coupling mode into SA (couple all).

The following list of analyzer functions can be automatically coupled:

Resolution bandwidth
Span

Average type (firmware revision A.08.00 or greater)
Marker functions

Detector (firmware revision A.08.00 or greater)
Marker functions
Average On Off
Average type

Attenuation
Reference level
External amplifier gain
Preamp

Center frequency step
Span (in swept spans)
Resolution bandwidth (in zero spans)

Video bandwidth
Resolution bandwidth

Tracking Generator
Sweep coupling mode (SR/SA)

VBW/RBW ratio (firmware revision A.08.00 or greater)

Sweep time
Span
Video bandwidth
Resolution bandwidth

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Sweep points
Phase noise optimization

Phase Noise Optimization (firmware revision A.08.00 or greater)
Span

NOTE Although marker count, gate time, and marker trace have auto settings, they are not affected by Couple.

Factory Preset and *RST: All

Front Panel Access: **Auto Couple, Auto All**

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DISPlay Subsystem

The DISPlay subsystem controls the selection and presentation of textual, graphical, and trace information. Within a display, information may be separated into individual windows.

Active Function Position

:DISPlay:AFUNction:POSition BOTTom|CENTer|TOP

:DISPlay:AFUNction:POSition?

Changes the position of the active function block.

Factory Preset and *RST: The factory default is center. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Range: Top, Center, or Bottom

Front Panel Access: **Display**

History: Added with firmware revision A.10.00.

Display Viewing Angle

:DISPlay:ANGLe <integer>

:DISPlay:ANGLe?

Changes the viewing angle for better viewing in different environments.

Factory Preset and *RST: The factory default is 4. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Range: Integer, 1 to 7

Front Panel Access: **Viewing angle keys**

Date and Time Display Format

:DISPlay:ANNotation:CLOCk:DATE:FORMat MDY|DMY

:DISPlay:ANNotation:CLOCk:DATE:FORMat?

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Allows you to set the format for displaying the real-time clock. To set the date time use: SYSTem:DATE <year>, <month>, <day>.

Factory Preset and *RST: The factory default is MDY. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **System, Time/Date, Date Format MDY DMY**

Date and Time Display

:DISPlay:ANNotation:CLOCk[:STATe] OFF|ON|0|1

:DISPlay:ANNotation:CLOCk[:STATe]?

Turns on and off the display of the date and time on the spectrum analyzer screen.

Factory Preset and *RST: The factory default is On. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle. Front Panel Access: **System, Time/Date, Time/Date On Off**

Display Annotation Title Data

:DISPlay:ANNotation:TITLe:DATA <string>

:DISPlay:ANNotation:TITLe:DATA?

Enters the text that will be displayed in the user title area of the display.

Front Panel Access: **Display, Title**

Display, Title, Change Title

Display, Title, Clear Title

Turn the Entire Display On/Off

:DISPlay:ENABle OFF|ON|0|1

Turns the display on or off. Having the display turned off may increase repetitive measurement rate.

The following key presses will turn display enable back on:

1. If in local, press any key
2. If in remote, press the local (system) key

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3. If in local lockout, no key (the computer must either cancel local lockout, or re-enable the display)

Factory Preset and *RST: On

Turn the Full Screen Display On/Off

`:DISPlay:MENU:STATe OFF|ON|0|1`

`:DISPlay:MENU:STATe?`

Turns the full screen display mode on or off. Press **System, System** to turn off full screen mode.

History: Added with firmware revision A.08.00.

Window Annotation

`:DISPlay:WINDow:ANNotation[:ALL] OFF|ON|0|1`

`:DISPlay:WINDow:ANNotation[:ALL]?`

Turns the screen annotation on or off for all windows.

Factory Preset and *RST: On

Front Panel Access: **Display, Preferences, Annotation On Off**

Trace Graticule Display

`:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe] OFF|ON|0|1`

`:DISPlay:WINDow:TRACe:GRATicule:GRID[:STATe]?`

Turns the graticule on or off.

Factory Preset and *RST: On

Front Panel Access: **Display, Preferences, Graticule On Off**

Trace X-Axis Scale Offset

`:DISPlay:WINDow:TRACe:X[:SCALe]:OFFSet <freq>`

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:DISPlay:WINDow:TRACe:X[:SCALe]:OFFSet?

Specifies the frequency offset for all frequency readouts such as center frequency, except that it does not affect marker count.

Factory Preset and *RST: 0 Hz

Range: –500 THz to 500 THz

Default Unit: Hz

History: Prior to firmware revision A.06.00, the lower range is –3 GHz.

Remarks: Frequency offset is not available when frequency scale type is Log (**[:SENSe]:SWEep:SPACing LINear|LOGarithmic**).

Front Panel Access: **FREQUENCY/Channel, Freq Offset**

Display Line Amplitude

:DISPlay:WINDow:TRACe:Y:DLINe <ampl>

:DISPlay:WINDow:TRACe:Y:DLINe?

Defines the level of the display line, in the active amplitude units if no units are specified.

Factory Preset and *RST: 2.5 divisions below the reference level

Range: 10 display divisions below the reference level to the reference level

Default Unit: Current active units

Front Panel Access: **Display, Display Line On Off**

Display Line On/Off

:DISPlay:WINDow:TRACe:Y:DLINe:STATe OFF|ON|0|1

:DISPlay:WINDow:TRACe:Y:DLINe:STATe?

Turns the display line on or off.

Factory Preset and *RST: Off

Front Panel Access: **Display, Display Line On Off**

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IF Gain Auto/Reference Level Auto Ranging

`:DISPlay:WINDow:TRACe:Y[:SCALe]:LOG:RANGe:AUTO OFF|ON|0|1`

`:DISPlay:WINDow:TRACe:Y[:SCALe]:LOG:RANGe:AUTO?`

This command enables and disables auto ranging. The speed benefits gained with this command are realized only when in narrow resolution (digital) bandwidths. The setting of auto range has no effect when in analog resolution bandwidths.

Factory Preset and *RST: On

History: This command is available with firmware revision A.04.00 and later.

Remarks: When using digital resolution bandwidths (RBW < 1 kHz) the analyzer uses IF Gain auto ranging to set the optimum signal gain for digital processing. This technique produces the greatest measurement range without overloading the digital system. To increase the measurement speed this IF Gain auto ranging may be set to fixed mode. When in fixed mode, make sure the signal is not set above the reference level and the reference is set so that the signal is within the display range. When in fixed mode the measurement has approximately 70 dB of display range.

Front Panel Access: **AMPLITUDE/Y Scale, IF Gain Auto Fixed** (front panel access is available with firmware revision A.06.00 and later).

Normalized Reference Level

`:DISPlay:WINDow:TRACe:Y[:SCALe]:NRLevel <rel_ampl>`

`:DISPlay:WINDow:TRACe:Y[:SCALe]:NRLevel?`

Sets the normalized reference level.

NOTE See command **`:CALCulate:NTData[STATe] OFF|ON|0|1`**

Factory Preset and *RST: 0 dB

Range: –327.6 to 327.6 dB

Default Unit: Current active units

Front Panel Access: **View/Trace, Normalize, Norm Ref Lvl**

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Normalized Reference Level Position

:DISPlay:WINDow:TRACe:Y[:SCALe]:NRPosition <integer>

:DISPlay:WINDow:TRACe:Y[:SCALe]:NRPosition?

Selects the position of the normalized reference level. The top and bottom graticule lines correspond to 10 and 0, respectively.

NOTE See command **:CALCulate:NTData[STATe] OFF|ON|0|1**

Factory Preset and *RST: 10

Range: integer

Front Panel Access: **View/Trace, Normalize, Norm Ref Posn**

Trace Y-Axis Amplitude Scaling

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_ampl>

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?

Sets the per-division display scaling for the y-axis when y-axis units are set to amplitude units.

Factory Preset and *RST: 10 dB

Range: 0.1 to 20.0 dB

Default Unit: dB

Front Panel Access: **AMPLITUDE/Y Scale, Scale/Div**

Trace Y-Axis Frequency Scaling

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision:FREQuency <freq>

:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision:FREQuency?

This command sets the per-division display scaling for the y-axis, when the y-axis units are set to frequency units, such as when looking at FM deviation with the command **[:SENSe]:DEMod:VIEW[:STATe] OFF|ON|0|1**.

NOTE For Option 106 (Bluetooth FM Demodulation) only the query form of this command is available; the value is determined during alignment.

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Factory Preset and *RST: 20 kHz (with Options BAA or AYQ)

Approximately 40 kHz (with Option 106, Bluetooth FM Demodulation)

Range: 1 kHz to 240 kHz (with Options BAA or AYQ)

Fixed (with Option 106, Bluetooth FM Demodulation)

Default Unit: Hz

Front Panel Access: **AMPLITUDE/Y Scale, Scale/Div**

Trace Y-Axis Reference Level

`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <ampl>`

`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?`

Sets the amplitude value of the reference level for the y-axis.

Factory Preset and *RST:. 0 dBm

Range:. With zero reference level offset:

ESA E4401B, E4411B: –149.9 to 50 dBm
ESA E4402B, E4403B: —149.9 to 55 dBm

ESA E4404B: —149.9 to 55 dBm
ESA E4405B: —149.9 to 55 dBm
ESA E4407B, E4408B: –149.9 to 55 dBm

–149.9 to 55 dBm with zero reference level offset and max mixer level = –10 dBm. In external mixing, the range is –327.5 to –10 dBm with max mixer level = –10 dBm.

Default Unit:. Current active units

Remarks:. The input attenuator setting may be affected. The minimum displayed value of reference level is –327.6 dBm, and the maximum displayed value is 327.6 dBm. See the remarks given for the command **`:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>`**

Front Panel Access:. **Amplitude Y Scale, Ref Level**

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Trace Y-Axis Reference Level Offset

:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet <rel_ampl>

:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel:OFFSet?

Sets the amplitude level offset for the y-axis.

Factory Preset and *RST: 0 dB

Range: –327.6 to 327.6 dB

Default Unit: dB

Remarks: The sum of (reference level offset + reference level) is clipped to the range –327.6 to 327.6 dB. The maximum limits are determined by the setting of the first of these two parameters, within the boundaries of their individual limits when initially set.

For example, if the reference level is (first) set to –20 dBm, then the reference level offset can be set to values of –307.6 dB to 327.6 dB. In the case of a 327.6 dB reference level offset, the resultant reference level value changes to 307.6 dBm. The reference level value range can be initially set to values from –149.9 to 55 dBm.

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Setting the reference level offset value first yields the following: If the reference level offset is (first) set to –30 dB, then the reference level can be set to values of –327.6 to 25 dBm. The reference level is “clamped” at 25 dBm because its positive value of 55 dBm is reached at 25 dBm with an offset of –30 dB. Its own positive amplitude limit applies.

If the reference level offset is (first) set to 30 dB, then the reference level can be set to values of –327.6 to 85 dBm. Again, the positive amplitude limit of reference level (alone) is factored in to the resultant combined limit.

Front Panel Access: **Amplitude Y Scale, Ref Level Offst**

Vertical Axis Scaling

`:DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing LINear|LOGarithmic`

`:DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing?`

Specifies the vertical graticule divisions as log or linear units.

Factory Preset and *RST: Logarithmic

Front Panel Access: **AMPLITUDE/Y Scale, Scale Type Log Lin**

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FORMat Subsystem

The FORMat subsystem sets a data format for transferring numeric and array information. **TRACe[:DATA]** and **TRACe[:DATA]?** are affected by FORMat subsystem commands.

Byte Order

:FORMat:BORDer NORMal|SWAPped

:FORMat:BORDer?

This command selects the binary data byte order for data transfer. It controls whether binary data is transferred in normal or swapped mode. This command affects only the byte order for setting and querying trace data for the **:TRACe[:DATA]** and query **:TRACe[:DATA]?** commands.

NOTE Normal mode is when the byte sequence begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4. Swapped mode is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1.

Factory Preset and *RST: Normal

Numeric Data format

:FORMat[:TRACe][:DATA]ASCii|INTeger,32|REAL,32|REAL,64|UINTeger,16

:FORMat[:TRACe][:DATA]?

This command changes the format of the trace data input and output. It affects only the data format for setting and querying trace data for the **:TRACe[:DATA]** and query **:TRACe[:DATA]?** commands. **REAL** and **ASCii** formats will format trace data in the current amplitude units. The format of state data cannot be changed. It is always in a machine readable format only (machine units).

This command specifies the format used for trace data during data transfer across any remote port.

NOTE One-button measurement functions only support **Binary Real 32**, **Binary Real 64**, and **ASCii** data formats.

For corrected trace data (**:TRACe[:DATA]** with parameter **<trace_name>**), **REAL**, and **ASCii** formats will provide trace data in the current amplitude units. **INTeger** format will provide trace data in mdBm. The fastest mode is **INTeger,32**.

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For example: –24, 353 mdBm converts to –24.353 dBm.

ASCii - Amplitude values are in amplitude units separated by commas. **ASCii** format requires more memory than the binary formats. Handling large amounts of this type of data, takes more time and storage space.

Integer,32 - Binary 32-bit integer values in internal units (mdBm), in a definite length block.

Real,32 (or **64**) - Binary 32-bit (or 64-bit) real values in amplitude units, in a definite length block. Transfers of real data are done in a binary block format.

For uncorrected trace data (**:TRACe[:DATA]** with parameter **RAWTRACE**), **UINTeger**, and **INTeger** formats apply to **RAWTRACE** queries, and return uncorrected ADC values. The fastest mode is **UINTeger,16**.

UINTeger, 16 - Binary 16-bit unsigned integer uncorrected ADC values, in a definite length block.

Integer,32 - Binary 32-bit unsigned integer uncorrected ADC values in a definite length block.

A definite length block of data starts with an ASCII header that begins with # and indicates how many additional trace points are following in the block. Suppose the header is #512320:

- The first digit in the header (5) tells you how many additional digits/bytes there are in the header.
- The 12320 means that 12,320 data bytes follow the header.
- Divide this number of bytes by your selected data format bytes/point, either 8 (fo `Real 64`), 4 (for `Real 32` or `Int 32`), or 2 (for `UINT 16`). In this example, if you are using `Real 64` then there are 1540 trace points in the block.

Corrected Trace Data Types
:TRACe:DATA? <trace_name>

Data Type	Result
ASCII	Amplitude Units
INT,32 (fastest)	Internal Units
REAL,32	Amplitude Units
REAL,64	Amplitude Units

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Uncorrected Trace Data Types `:TRACe:DATA? RAWTRACE`	
Data Type	**Result**
INT,32	Uncorrected ADC Values
UINT,16 (fastest)	Uncorrected ADC Values

Factory Preset
and *RST: ASCII

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HCOPy Subsystem

The HCOPy subsystem controls the setup of plotting and printing to an external device.

Abort the Print

:HCOPy:ABORt

Aborts hard copy printout of results.

Front Panel Access: **ESC** (with print in progress)

Printer Type

:HCOPy:DEVice:TYPE AUTO|CUSTom|NONE

:HCOPy:DEVice:TYPE?

Sets up the printer by selecting printer type.

AUTO - the instrument queries the printer to determine the printer type and automatically sets itself for that printer

CUSTom - allows you to select a custom printer if your printer cannot be auto-configured

NONE - tells the instrument that the hard copy output device is not a printer

Factory Preset and *RST: The factory default is AUTO. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **Print Setup, Printer Type**

Color Hard Copy

:HCOPy:IMAGe:COLor[:STATe] OFF|ON|0|1

:HCOPy:IMAGe:COLor[:STATe]?

Selects between color and monochrome mode for hard copy output.

Factory Preset and *RST: The factory default is On. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

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Front Panel Access: **Print Setup, Color On Off**

Print a Hard Copy

:HCOPy[:IMMediate]

The entire screen is output to the parallel port.

Front Panel Access: **Print**

Form Feed the Print Item

:HCOPy:ITEM:FFEed[:IMMediate]

Sends the printer a command to form feed.

Front Panel Access: **Print Setup, Eject Page**

Page Orientation

:HCOPy:PAGE:ORIentation LANDscape|PORTrait

:HCOPy:PAGE:ORIentation?

Specifies the orientation of the print.

NOTE Landscape mode is not presently supported for PCL-3 printers.

Factory Preset and *RST: The factory default is Landscape. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **Print Setup, Orientation, Landscape**

Print Setup, Orientation, Portrait

Number of Items Printed on a Page

:HCOPy:PAGE:PRINts <integer>

:HCOPy:PAGE:PRINts?

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Sets the number of display print outputs sent to print on one piece of paper, before a form feed is sent.

Factory Preset and *RST: The factory default is 1. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Range: Integer, 1 or 2

Front Panel Access: **Print Setup, Prints/Page 1 2**

Printed Page Size

`:HCOPy:PAGE:SIZE A|B|A3|A4|LETTer|LEGal|EXECutive|LEDGer`

`:HCOPy:PAGE:SIZE?`

Formats the print image for the selected page size. Page size “A” is letter, and page size “B” is ledger. There is no size standardization for “legal” or “executive.”

Factory Preset and *RST: The factory default is letter. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **Print Setup, /Page Size**

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INITiate Subsystem

The INITiate subsystem is used to control the initiation of the trigger. Refer to the TRIGger and ABORt subsystems for related commands.

Continuous or Single Measurements

`:INITiate:CONTinuous OFF|ON|0|1`

`:INITiate:CONTinuous?`

Selects whether the trigger system is continuously initiated or not.

This command affects sweep if not in a measurement, and affects trigger when in a measurement. A "measurement" refers to any of the functions under the **MEASURE** key. This corresponds to continuous sweep or single sweep operation when not in a measurement, and continuous measurement or single measurement operation when in a measurement. Commands used for measurements in the **MEASURE** and **Meas Setup** menus are located in Volume 2 *"One-Button Power Measurements"*.

When not in a measurement, this command does the following:

- When ON at the completion of each sweep cycle, the sweep system immediately initiates another sweep cycle.
- When OFF, the sweep system remains in an "idle" state until CONTinuous is set to ON or an **`:INITiate[:IMMediate]`** command is received. On receiving the **`:INITiate[:IMMediate]`** command, it will go through a single sweep cycle, and then return to the "idle" state.
- The query returns 1 or 0 into the output buffer. 1 is returned when there is continuous sweeping. 0 is returned when there is only a single sweep.

When in a measurement, this command does the following:

- When ON at the completion of each trigger cycle, the trigger system immediately initiates another trigger cycle.
- When OFF, the trigger system remains in an "idle" state until CONTinuous is set to ON or an **`:INITiate[:IMMediate]`** command is received. On receiving the **`:INITiate[:IMMediate]`** command, it will go through a single trigger cycle, and then return to the "idle" state.
- The query returns 1 or 0 into the output buffer. 1 is returned when in a continuous measurement state. 0 is returned when there is only a single measurement.

Factory Preset: Continuous

*RST: Continuous, or On

Front Panel Access: **Sweep**, **Sweep Cont Single**

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Single

Meas Control, **Measure Cont Single**

Take New Data Acquisitions

`:INITiate[:IMMediate]`

This command initiates a sweep if not in a measurement. If in a measurement, it triggers the measurement. A “measurement” refers to any function under the **MEASURE** key.

Remarks: See also the **`*TRG`** command

Use the **`:TRIGer[:SEQuence]:SOURce EXTernal`** command to select the external trigger.

The instrument must be in the single measurement mode. If :INITiate:CONTinuous is ON then the command is ignored.

Use **`:FETCh?`** to transfer a measurement result from memory to the output buffer. Refer to individual commands in the MEASure subsystem for more information.

If the analyzer is in signal identification mode, two sweeps are required, as this mode relies on the acquisition of data from two successive sweeps. Therefore, if the analyzer is in single sweep mode, two sweep triggers are needed to generate the sweep pair. In image suppress mode, synchronization is ensured by first turning off signal identification, initiating a single sweep, then turning on signal identification followed by two single sweeps. See **`[:SENSe]:SIDentify`** for more information about signal identification state.

Front Panel Access: **Sweep, Sweep Cont Single**

Single

Meas Control, Measure Cont Single

Pause the Measurement

`:INITiate:PAUSe`

This command applies to measurements found in the **MEASURE** menu. Use this command to pause the current measurement by changing the current measurement state from the “wait for trigger” state to the “paused” state. If the measurement is not in the “wait for trigger” state when the command is issued, the transition will be made the next time that state is entered as part of the trigger cycle. When in the pause state, the analyzer auto-align process stops. If the analyzer is paused for a

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long period of time, measurement accuracy may degrade.

Front Panel Access: **Meas Control, Pause**

Restart the Measurement

`:INITiate:RESTart`

This command applies to measurements found in the **MEASURE** menu. Use this command to restart the present measurement from the "idle" state, regardless of its operating state. It is equivalent to **`:INITiate[:IMMediate]`** for single measurement mode, or **`:ABORt`** for continuous measurement mode.

Front Panel Access: **Restart**

Meas Control, Restart

Resume the Measurement

`:INITiate:RESume`

This command applies to measurements found in the **MEASURE** menu. Use this command to resume the current measurement by changing the current measurement state from the "paused" state back to the "wait for trigger" state.

Front Panel Access: **Meas Control, Resume**

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INPut Subsystem

The INPut subsystem controls the characteristics of analyzer input ports.

Input Port Coupling

:INPut:COUPling AC|DC

:INPut:COUPling?

Selects ac or dc coupling for the front panel INPUT port. A blocking capacitor is switched in for the ac mode.

CAUTION Instrument damage can occur if there is a dc voltage present at the INPUT and dc coupling is selected.

Factory Preset and *RST: ac

Remarks: This command is available only on Agilent ESA spectrum analyzer models E4402B Option UKB, E4407B Option UKB, E4404B, or E4405B. See Table 5-1 for frequency range limits for your ESA model and option.

Table 5-1 Selecting Input Coupling

Model Number	AC Frequency Range	DC Frequency Range
E4402B with *Option UKB*	100 kHz to 3 GHz	100 Hz to 3 GHz
E4404B	100 kHz to 6.7 GHz	9 kHz to 6.7 GHz
E4404B with *Option UKB*	100 kHz to 6.7 GHz	100 Hz to 6.7 GHz
E4405B	100 kHz to 13.2 GHz	9 kHz to 13.2 GHz
E4405B with *Option UKB*	100 kHz to 13.2 GHz	100 Hz to 13.2 GHz
E4407B with *Option UKB*	10 MHz to 26.5 GHz	100 Hz to 26.5 GHz

Front Panel Access: **Input/Output (or Input), Coupling AC DC**

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Select Internal or External Mixer

:INPut:MIXer INTernal|EXTernal

:INPut:MIXer?

This command selects either the internal or external input mixer and is available only with Option AYZ (External Mixing).

Refer also to commands in the **[:SENSe]:MIXer** subsection.

Factory Preset and *RST: INTernal

History: This command is available with firmware revision A.03.00 and later.

Remarks: External mixing is not available when frequency scale type is Log (**[:SENSe]:SWEep:SPACing LINear|LOGarithmic**).

Selecting the external input mixer activates all the keys in the Input Mixer menu and changes the RF attenuation annotation readout on the display to “Ext Mix.”

Front Panel Access: **Input/Output (or Input), Input Mixer Int Ext**

Select Mixer Type

:INPut:MIXer:TYPE PRESelected|UNPReselect

:INPut:MIXer:TYPE?

This command selects the type of mixer being used and is available only with Option AYZ (External Mixing).

Refer also to commands in the **[:SENSe]:MIXer** subsection.

Factory Preset and *RST: UNPReselect

History: This command is available with firmware revision A.03.00 and later.

Remarks: Setting mixer type to Presel activates a tuning signal that is routed to the PRESEL TUNE OUTPUT connector on the analyzer rear panel. This signal drives the tune input of the HP/Agilent 11974-Series Preselected Mixers at 1.5V/GHz. The sweep rate in this mode is limited to 40 MHz/msec.

NOTE Preselected Mixer Type is not allowed when AUTO harmonic and Ext Mix Band K, E, W, F, D, G, Y, or J is selected.

Front Panel Access: **Input/Output (or Input), Input Mixer, Mixer Config, Mixer**

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Type Presel Unpre

Clear the Input Overload

`:INPut:PROTection:CLEar`

Resets the overload protection circuitry for the input connector. There is no query form of this command.

NOTE

This command is valid only for Agilent ESA models E4401B or E4411B.

The excessive input signal may have caused 15 dB of attenuation to be switched in, or it may have completely switched the input connector out so that it is connected to the internal reference signal.

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INSTrument Subsystem

This subsystem includes commands for querying and selecting instrument measurement (personality option) modes.

Catalog Query

:INSTrument:CATalog?

Returns a comma separated list of strings which contains the names of all the installed applications. These names can only be used with the `INST:SELECT` command.

Example: INST:CAT?

Query response: ”CDMA”4,”PNOISE”14

Select Application by Number

:INSTrument:NSELect <integer>

:INSTrument:NSELect?

Select the measurement mode by its instrument number. The actual available choices depends upon which applications are installed in the instrument.

NOTE

If you are using the SCPI status registers and the analyzer mode is changed, the status bits should be read, and any error conditions resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Therefore, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

1 = SA
3 = GSM
4 = CDMA (cdmaOne)
14 = PNOISE (phase noise)
252 = EDGE
219 = NFIGURE (noise figure)
228 = BLUETOOTH
227 = CATV (Cable TV)
229 = MAN (Modulation Analysis)
231 = LINK (89600 VSA Link Software)

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Example: INST:NSEL 4

Factory Preset: Persistent state with factory default of

Range: 1 to x, where x depends upon which applications are installed.

Front Panel Access: **MODE**

Select Application

:INSTrument[:SELect] 'SA'|'GSM'|'CDMA'|'PNOISE'|'BLUETOOTH'|'EDGE'|'MAN'|'LINK'|'CATV'|'NFIGURE'

:INSTrument[:SELect]?

Select the measurement mode. The actual available choices depend upon which modes (measurement applications) are installed in the instrument. A list of the valid choices is returned with the INST:CAT? query.

Once an instrument mode is selected, only the commands that are valid for that mode can be executed.

NOTE

If you are using the SCPI status registers and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

SA (Spectrum Analysis)
GSM
CDMA (cdmaOne)
PNOISE (phase noise)
EDGE
NFIGURE (noise figure)
BLUETOOTH
CATV (Cable TV)
MAN (Modulation Analysis)
LINK (89600 VSA Link Software)

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NOTE

If you are using the status bits and the analyzer mode is changed, the status bits should be read, and any errors resolved, prior to switching modes. Error conditions that exist prior to switching modes cannot be detected using the condition registers after the mode change. This is true unless they recur after the mode change, although transitions of these conditions can be detected using the event registers.

Changing modes resets all SCPI status registers and mask registers to their power-on defaults. Hence, any event or condition register masks must be re-established after a mode change. Also note that the power up status bit is set by any mode change, since that is the default state after power up.

Example: INST:SEL ‘CDMA’

Factory Preset: Persistent state with factory default of Spectrum Analyzer mode

Front Panel Access: **MODE**

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MMEMory Subsystem

The purpose of the MMEMory subsystem is to provide access to mass storage devices such as internal or external disk drives.

NOTE Refer also to **:CALCulate** and **:TRACe** subsystems for more trace and limit line commands.

Agilent ESA analyzers use two types of mass storage devices:

- 3.5 inch disk drive (high density, 1.44 MBytes formatted) designated “A:”
- Part of flash memory and treated as a device designated “C:”

The MMEMory command syntax term **<file_name>** is a specifier having the form: drive:\directory\name.ext, where the following rules apply:

- “drive” is “A:” or “C:”
- “\directory\” is the path name
- “name” is a DOS file name of up to eight characters, letters (A-Z, a-z) and numbers (0-9) only (lower case letters are read as uppercase)
- “ext” is an optional file extension using the same rules as “name,” but consists of up to three characters total

Catalog the Selected Memory Location

:MMEMory:CATalog? <drive>

where “drive” is “A:” or “C:”

Lists all files in the specified drive. The return data will be of the format: **<mem_used>,<mem_free>,<file_listing>**

Each **<file listing>** indicates the name, and size of one file in the directory list: **<file_name>,<file_size>**

Example: `Catalog drive C:`, which is in instrument memory:
:MMEMory:CATalog? “C:”

Front Panel Access: **File**

Copy a File

:MMEMory:COPY <file_name1>,<file_name2>

To copy a file, the source file name is <file_name1> and the destination file name is <file_name2>.

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Example: `:MMEM:COPY "C:oldname.sta","A:\newname.sta"`

Front Panel Access: **File, Copy**

Move Data to File

`:MMEMory:DATA <file_name>,<definite_length_block>`

`:MMEMory:DATA? <file_name>`

Loads **<definite_length_block>** into the memory location **<file_name>**.

The query returns the contents of the <file_name> in the format of a definite length block. This command can be used for copying files out of the analyzer over the remote bus. Refer to chapter 3, Programming Examples, for more information.

Example: Load "abcd" into C:source.txt:
`:MMEM:DATA "C:source.txt",#14abcd`

Delete a File

`:MMEMory:DELete <file_name>`

Delete a file.

Example: `:MMEM:DEL "C:source.txt"`

Remarks: If <file_name> does not exist, a "File Name Error" will occur.

Front Panel Access: **File, Delete**

Load a Corrections Table from a File

`:MMEMory:LOAD:CORRection`
`ANTenna|CABLe|OTHer|USER,<file_name>`

Loads the data in the file <file_name> to the specified correction set.

Example: `:MMEM:LOAD:CORR ANT, "A:TEST5.CBL"`

Front Panel Access: **File, Load, Type, Corrections**

Load a Limit Line from Memory to the Instrument

`:MMEMory:LOAD:LIMit LLINE1|LLINE2,<file_name>`

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Loads a limit line, from the specified file in mass storage to the instrument. Loading a time limit line deletes any frequency limit lines. Similarly, loading a frequency limit line deletes any time limit lines.

Example: **:MMEM:LOAD:LIM LLINE2,"C:mylimit.lim"**

Remarks: There is no SCPI short form for parameters **LLINE1**|**LLINE2**.

Front Panel Access: **File, Load, Type, Limits**

Load an Instrument State from a File

:MMEMory:LOAD:STATe 1,<file_name>

The contents of the state file are loaded into the current instrument state.

Example: **:MMEM:LOAD:STAT 1,"C:mystate.sta"**

Remarks: You must be in Spectrum Analysis mode to use this command. The ***RCL** commands loads all of the mode states.

See also commands **:MMEMory:LOAD:STATe** and **:MMEMory:STORe:STATe**

If the revision of the state being loaded is newer than the revision of the instrument, no state is recalled and an error is reported.

If the revision of the state being loaded is equal to the revision of the instrument, all regions of the state will be loaded.

If the revision of the state being loaded is older than the revision of the instrument, the instrument will only load the older regions of the state.

Front Panel Access: **File, Load, Type, State**

Load a Trace From a File to the Instrument

:MMEMory:LOAD:TRACe <file_name>

The contents of the file are loaded into TRACE1. The file name must have a file extension of .trc. These files contain and load a trace with its state. Files with the .csv extension (using the comma-separated values format) contain only trace data and they cannot be used to load a trace into the instrument.

Example: **:MMEM:LOAD:TRAC "C:mytrace.trc"**

Remarks: See also commands **:MMEMory:LOAD:STATe** and **:MMEMory:STORe:STATe**

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If the revision of the state being loaded is newer than the revision of the instrument, no state is recalled and an error is reported.

If the revision of the state being loaded is equal to the revision of the instrument, all regions of the state will be loaded.

If the revision of the state being loaded is older than the revision of the instrument, the instrument will only load the older regions of the state.

Make a Directory

:MMEMory:MDIRectory <dir_path>

where "path" is "A:\" or "C:\"

Makes a directory or subdirectory in the specified path.

Example: Make a directory in C:\, which is in instrument memory:
:MMEMory:MDIRectory "C:\"

Front Panel Access: **File, Create Dir**

Delete a Directory

:MMEMory:RDIRectory <dir_name>

Deletes the specified directory and all files and subdirectories within that directory.

Front Panel Access: **File, Delete**

Set the Save Screen Image File Type

:MMEMory:SCReen:FORMat BITMap|METafile

Allows you to set the format of the screen image to bitmap or metafile format.

History: Added with firmware revision A.12.00.

Front Panel Access: **File, Save, Type, Screen, Format**

Set the Save Screen Image Background

:MMEMory:SCReen:BACKground NORMal|REVerse

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Allows you to set the display background to normal or reverse. Reverse is used to change the dark background to a light background for printing purposes.

History: Added with firmware revision A.12.00.

Front Panel Access: **File, Save, Type, Screen, Format**

Reverse the Colors of the Display

:MMEMory:SCReen:BACKground NORMal|REVerse

:MMEMory:SCReen:BACKground?

This reverses the screen colors for screen file saving. It lets you save a screen file that has green traces on a white background, so it does not take as much black ink to print the background. Use the save command: :MMEMory:SCReen:STORe <file_name> to save the reversed file.

Example: `:MMEM:SCR:BACK REV`

Front Panel Access: **File**

Store a Corrections Table to a File

:MMEMory:STORe:CORRection ANTenna|CABLe|OTHer|USER,<file_name>

Stores the specified correction set to the file named <file_name>.

Example: **:MMEM:STOR:CORR ANT, "A:TEST1.ANT"**

Remarks: This command will fail if the **<file_name>** already exists.

Front Panel Access: **File, Save, Type, Corrections**

Store a Limit Line in a File

:MMEMory:STORe:LIMit LLINE1|LLINE2,<file_name>

Stores the specified limit line to the specified file in memory.

Example: **:MMEM:STOR:LIM LLINE2,"C:mylimit.lim"**

Remarks: This command will fail if the **<file_name>** already exists. There is no SCPI short form for parameters **LLINE1|LLINE2**.

Front Panel Access: **File, Save, Type, Limits**

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Store Measurement Results in a File

:MMEMory:STORe:RESults <file_name>

Saves the results of the current measurement into a comma-separated file. Only works when a measurement has been chosen from the **MEASURE** menu. SCPI commands associated with these measurements are located in Volume 2 *"One-Button Power Measurements"*. The filename extension is .CSV. This command will fail if the file **<file_name>** already exists.

Example: **:MMEM:STOR:RES "A:ACP.CSV"**

Front Panel Access: **File, Save, Type, Measurement Results**

Store a Screen Image in a Graphic File

:MMEMory:STORe:SCReen <file_name>

Saves the current instrument screen image, as a graphic file, to the specified file in memory. The file must have a .gif or .wmf file extension. The specified file extension determines which file format the instrument will use to save the image. Use the MMEM:SCReen:BACKground REVerse command to reverse the display image before saving the screen file.

Example: **:MMEM:STOR:SCR "C:myscreen.gif"**

Remarks: This command will fail if the **<file_name>** already exists.

Front Panel Access: **File, Save, Type, Screen**

Store an Instrument State in a File

:MMEMory:STORe:STATe 1,<file_name>

Saves the instrument state to the file in memory. This file data is only readable by the analyzer.

Example: **:MMEM:STOR:STAT 1,"C:mystate.sta"**

Remarks: You must be in Spectrum Analysis mode to use this command. The ***SAV** commands stores all of the mode states.

This command will fail if the **<file_name>** already exists.

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Store a Trace in a File

`:MMEMory:STORe:TRACe <label>,<file_name>`

Saves the specified trace to a file in memory. The file name must have a file extension of :csv or :trc. The file extension determines whether just the trace data is stored, or the trace is stored with its state. The .csv extension uses the CSV (comma-separated values) format for the trace data in frequency/amplitude pairs. The .trc extension is for files that include both trace and state data. The .trc file data is only readable by the analyzer.

Example: **`:MMEM:STOR:TRAC TRACE3,"C:mytrace.trc"`**

Range: Trace labels are: TRACE1|TRACE2|TRACE3|ALL

Remarks: This command will fail if the **`<file_name>`** already exists.

Front Panel Access: **File, Save, Type, Trace**

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OUTPut Subsystem

The OUTPut subsystem controls the characteristics of the tracking generator output port. Refer to the "SOURce Subsystem" on page 343, which also contains commands that control the characteristics of the tracking generator.

Turn Output On/Off

`:OUTPut[:STATe] OFF|ON|0|1`

`:OUTPut[:STATe]?`

Controls the tracking generator output.

Factory Preset and *RST: Off

Front Panel Access: **Source, Amplitude On Off**

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SENSe Subsystem

Sets the instrument state parameters so that you can measure the input signal.

SENSe subsystem commands used for measurements in the **MEASURE** and **Meas Setup** menus are located in Volume 2 *"One-Button Power Measurements"*. These commands may be used only to set parameters of a specific measurement when the measurement is active.

Auto-range Dwell Time

[:SENSe]:ARDTime <time>

[:SENSe]:ARDTime?

Sets the auto-range dwell time for the EMI Detectors. The amplitude ranging process optimizes the available dynamic range for the measurement. The dwell time is the time spent auto-ranging. You may need to set this value if you have a signal with a very low PRF signal (< 5Hz). Dwell time must be > 1/PRF. (See also `SENSe:DETector:FUNCtion:EMI`)

Factory Preset and *RST:	0.2 s
Range:	0.001 to 2000 s (The actual minimum value varies. It is dependent on the number of trace points and the ADC period.)
Remarks:	This command is only available with Option AYQ installed.
History:	Added with firmware revision A.14.00.
Front Panel Access:	**Det/Demod**, **EMI Detector**

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[:SENSe]:AVERage Subsection

Clear the Current Average

[:SENSe]:AVERage:CLEar

Re-start the trace averaging function.

NOTE Re-start the trace at the beginning of a sweep to obtain valid average data. To do this, remotely abort the sweep and initiate a single sweep.

Set the Average Count

[:SENSe]:AVERage:COUNt <integer>

[:SENSe]:AVERage:COUNt?

Specifies the number of measurements that are combined.

Factory Preset and *RST: 100

Range: 1 to 8192

Front Panel Access: **BW/Avg, Average On Off**

Turn Averaging On/Off

[:SENSe]:AVERage[:STATe] OFF|ON|0|1

[:SENSe]:AVERage[:STATe]?

This command toggles averaging off and on. Averaging combines the value of successive measurements to average out measurement variations.

Factory Preset and *RST: Off

Remarks: When a measurement under the front panel **MEASURE** key is started, this command is turned off for video averaging (**[:SENSe]:AVERage:TYPE VIDeo**). If this command is turned on for video averaging when any of the **MEASURE** key measurements are in progress, that measurement will be stopped.

Front Panel Access: **BW/Avg, Average On Off**

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Turn Automatic Averaging On/Off

[:SENSe]:AVERage:TYPE:AUTO OFF|ON|0|1

[:SENSe]:AVERage:TYPE:AUTO?

Sets the averaging to be automatically set to the appropriate type for the current measurement setup. Or allows you to manually choose the type of averaging with **[:SENSe]:AVERage:TYPE**.

When AUTO is On:

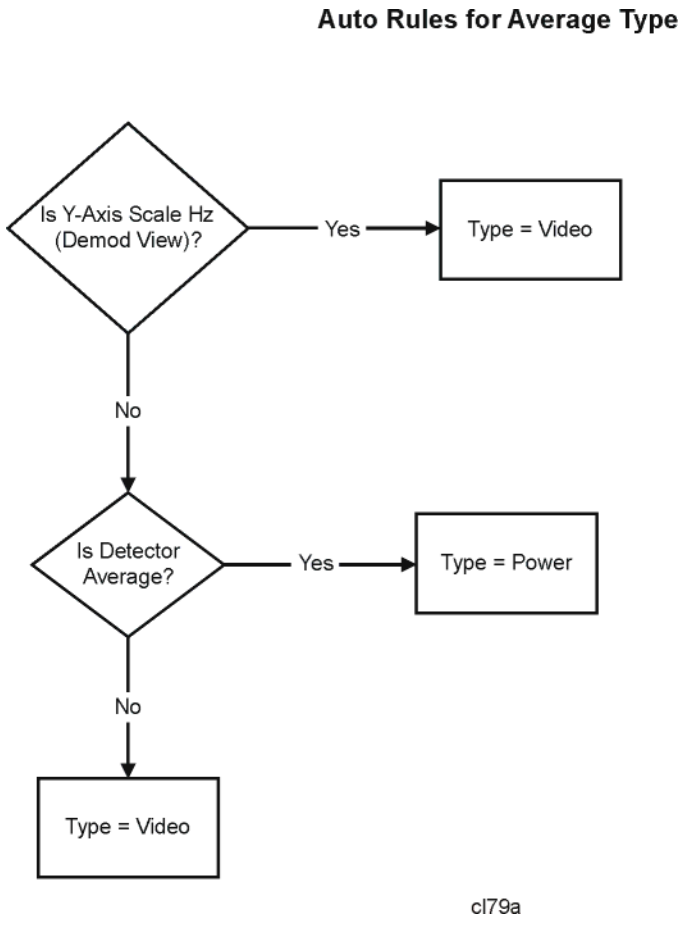
If the Y Axis Scale is not Linear or Log, then average type is Video (Y Axis Scale) Averaging.

If the Y Axis Scale is Linear or Log, then average type is Power Averaging.

If the Detector is Peak, Sample, or Negative Peak (not Average), then average type is Video Average.

See Figure 5-1, which shows these auto rules for average type in flowchart format.

Figure 5-1 Auto Rules for Average Type



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Factory Preset and *RST: On

History: Added with firmware revision A.08.00.

Front Panel Access: **BW/Avg, Avg Type, Auto Man**

Type of Averaging for Measurements

[:SENSe]:AVERage:TYPE VIDeo|RMS

[:SENSe]:AVERage:TYPE?

Successive measurements of data can be combined to average out measurement variations. Detector is set to average and Avg type is set to power (RMS) to measure RMS voltage (avg power).

NOTE As a best practice, set amplitude scale (**:DISP:WIND:TRAC:Y:SPAC**) prior to average type.

VIDeo logarithmically averages the power of the video data (typical units are dBm). This command is equivalent to pressing front panel keys **BW/Avg, Avg Type, Video.**

RMS averages the linear power of successive measurements (typical units are watts).

The following parameters of this command are supported, but not recommended for new designs. They are provided for limited compatibility to other spectrum analyzers. When used, the parameters are converted as follows:

TYPE LINear maps to RMS.

TYPE LPOWer maps to VIDeo.

TYPE POWer maps to RMS.

TYPE SCALar and VOLTage will map to VIDeo in linear amplitude scale. If the amplitude scale is LOG, an error is generated.

TYPE LOG maps to VIDeo. If the amplitude scale is not LOG (linear or Y Axis Units = Hz), an error is generated.

For compatibility with firmware revisions prior to A.08.00, query **[:SENSe]:AVERage:TYPE?** will return LPOW or POW if LPOW or POW is used during the setting and no further changes have occurred to set the average type (such as from the front panel).

Factory Preset and *RST: VID

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History: Changed with firmware revision A.08.00.

Front Panel Access: **BW/Avg, Avg Type**

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[:SENSe]:BANDwidth Subsection

Resolution Bandwidth

[:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>

[:SENSe]:BANDwidth|BWIDth[:RESolution]?

Specifies the resolution bandwidth.

Example: `BAND 1 kHz`

Range: 1 kHz to 5 MHz (standard instrument)

100 Hz to 5 MHz (E4411B, E4403B, E4408B with Option 1DR)

10 Hz to 5 MHz (E4401B, E4402B, E4404B, E4405B, E4407B with Option 1DR)

1 Hz to 5 MHz (E4401B, E4402B, E4404B, E4405B, E4407B with Options 1DR and 1D5)

Default Unit: Hz

Front Panel Access: **BW/Avg, Resolution BW Auto Man**

Resolution Bandwidth Automatic

[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO OFF|ON|0|1

[:SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO?

Couples the resolution bandwidth to the frequency span.

Factory Preset and *RST: On

Example: `BWID:AUTO On`

History: This command function changed with firmware revision A.08.00. With :**AUTO ON** in zero span, an error will be generated.

Remarks: Auto-couple resolution bandwidth is not available in zero span.

Video Bandwidth

[:SENSe]:BANDwidth|BWIDth:VIDeo <freq>

[:SENSe]:BANDwidth|BWIDth:VIDeo?

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Specifies the video bandwidth.

Factory Preset and *RST: 3 MHz

Range: 1 Hz to 3 MHz. This range is dependent upon the setting of **[:SENSe]:BANDwidth|BWIDth[:RESolution]** and installed options.

Default Unit: Hz

Front Panel Access: **BW/Avg, Video BW Auto Man**

Video Bandwidth Automatic

[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO OFF|ON|0|1

[:SENSe]:BANDwidth|BWIDth:VIDeo:AUTO?

Couples the video bandwidth to the resolution bandwidth.

Factory Preset and *RST: On

Front Panel Access: **BW/Avg, Video BW Auto Man**

Video to Resolution Bandwidth Ratio

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio <number>

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio?

Specifies the ratio of the video bandwidth to the resolution bandwidth.

Factory Preset and *RST: 1.0

Range: 0.00001 to 3.0e6

Front Panel Access: **BW/Avg, VBW/RBW Ratio**

Video to Resolution Bandwidth Ratio Mode Select

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio:AUTO OFF|ON|0|1

[:SENSe]:BANDwidth|BWIDth:VIDeo:RATio:AUTO?

Selects auto or manual mode for video bandwidth to resolution bandwidth ratio.

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Refer to Figure 2-3 on page 61, which is a flowchart that illustrates VBW and RBW Ratio auto rules.

Factory Preset and *RST: On

History: Added with firmware revision A.08.00.

Front Panel Access: **BW/Avg, VBW/RBW, Auto Man**

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[:SENSe]:CORRection Subsection

Delete All Corrections

[:SENSe]:CORRection:CSET:ALL:DELete

This command deletes all existing corrections.

History: Added with firmware revision A.08.00.

Front Panel Access: **Amplitude/Y Scale, Corrections, Delete All Corrections**

Perform Amplitude Correction

[:SENSe]:CORRection:CSET:ALL[:STATe] OFF|ON|0|1

[:SENSe]:CORRection:CSET:ALL[:STATe]?

Turns On or Off the amplitude corrections. When turned On, only the correction sets that were turned on are enabled. When turned Off, all of the correction sets are disabled.

Factory Preset and *RST: Off

Remarks: To turn On or Off an individual correction set, use: **[:SENSe]:CORRection:CSET[1]|2|3|4[:STATe]**.

Front Panel Access: **Amplitude/Y Scale, Corrections, Antenna, Correction On Off**

Amplitude/Y Scale, Corrections, Cable, Correction On Off

Amplitude/Y Scale, Corrections, Other, Correction On Off

Amplitude/Y Scale, Corrections, User, Correction On Off

Set Amplitude Correction Data

[:SENSe]:CORRection:CSET[1]|2|3|4:DATA <freq>,<rel_ampl>{,<freq>,<rel_ampl>}

[:SENSe]:CORRection:CSET[1]|2|3|4:DATA?

Sets the amplitude correction data. These frequency/amplitude corrections will be applied to the displayed data to correct for system losses/gains outside the analyzer. Four different sets of correction data can be stored.

Example: **:CORR:CSET1:DATA**

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```
900E6,0.3,1.0E9,0.35,1.3E9,0.2
```

Range: 200 points per set

Default Unit: There are no units on the frequency and amplitude pairs. They must be entered in hertz (Hz) and decibels (dB).

Remarks: CSET number equivalents to front panel access definitions are as follows:

CSET or CSET1 is Antenna
CSET2 is Cable
CSET3 is Other
CSET4 is User

Front Panel Access:

Amplitude/Y Scale, Corrections, Antenna, Edit Point|Frequency|Amplitude|Delete Point

Amplitude/Y Scale, Corrections, Cable, Edit Point|Frequency|Amplitude|Delete Point

Amplitude/Y Scale, Corrections, Other, Edit Point|Frequency|Amplitude|Delete Point

Amplitude/Y Scale, Corrections, User, Edit Point|Frequency|Amplitude|Delete Point

Merge Additional Values into the Existing Amplitude Correction Data

```
[:SENSe]:CORRection:CSET[1]|2|3|4:DATA:MERGe
<freq>,<rel_ampl>{,<freq>,<rel_ampl>}
```

Adds the points with the specified values to the current amplitude correction data, allowing you to merge correction data. If too much data is merged, as many points as possible are merged into the existing data and then an error is reported.

- **<freq>** is the frequency (in Hz) where the correction should be applied; no unit is allowed in this parameter
- **<rel_ampl>** is the amount of relative amplitude correction (in dB) needed; no unit is allowed in this parameter

Remarks: CSET number equivalents to front panel access definitions are as follows:

CSET or CSET1 is Antenna
CSET2 is Cable
CSET3 is Other
CSET4 is User

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Delete Amplitude Correction

[:SENSe]:CORRection:CSET[1]|2|3|4:DELete

Deletes the specified correction set. If the set was On, it is turned Off.

Front Panel Access: **AMPLITUDE/Y Scale, Corrections, Antenna|Cable|Other|User, Delete Correction**

Set Amplitude Correction Frequency Interpolation

[:SENSe]:CORRection:CSET[1]|2|3|4:X:SPACing LINear|LOGarithmic

Sets the frequency interpolation to linear or logarithmic for the specified correction set.

Remarks: Logarithmic frequency scale corrections are linearly interpolated between correction points with respect to the logarithm of the frequency. Linear frequency scale corrections are interpolated along straight lines, connecting adjacent points on a linear scale.

Front Panel Access: **AMPLITUDE/Y Scale, Corrections, Freq Interp Log Lin**

Perform Amplitude Correction

[:SENSe]:CORRection:CSET[1]|2|3|4[:STATe] OFF|ON|0|1

[:SENSe]:CORRection:CSET[1]|2|3|4[:STATe]?

Turns the amplitude correction function on or off for the given set.

NOTE **[:SENSe]:CORRection:CSET:ALL[:STATe]** must be on for this command to function.

Factory Preset and *RST: Off

Remarks: CSET number equivalents to front panel access definitions are as follows:

CSET or CSET1 is Antenna
CSET2 is Cable
CSET3 is Other
CSET4 is User

Front Panel

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Access: **AMPLITUDE/Y Scale, Corrections, Antenna|Cable|Other|User, Correction On Off**

Input Impedance Correction

[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude] <number>

[:SENSe]:CORRection:IMPedance[:INPut][:MAGNitude]?

Amplitude correction is applied to the display data to adjust for measurement situations where the unit under test has a different impedance than the 50 Ω input impedance of the analyzer. Some Agilent ESA analyzers have Option 1DP, 75 Ω input. In this case, you may want to convert the data to make measurements in a 50 Ω system.

Factory Preset and *RST: The factory default is the input impedance of the analyzer.

Range: 50 or 75 ohms

Default Unit: ohms

Front Panel Access: **Input, Input Z Corr 50 Ω 75 Ω**

External Amplifier Correction

[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel_ampl>

[:SENSe]:CORRection:OFFSet[:MAGNitude]?

A single value of amplitude correction can be applied to the displayed trace data to compensate for signal losses or gains that are due to other devices in the measurement setup, rather than the unit under test.

Factory Preset and *RST: 0 dB

Range: –81.9 to 81.9

Default Unit: dB

Front Panel Access: **AMPLITUDE/Y Scale, Ext Amp Gain**

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[:SENSe]:DEMod Subsection

Type of Demodulation

[:SENSe]:DEMod AM|FM

[:SENSe]:DEMod?

Sets the type of demodulation. FM is only available with Option BAA, AYQ or 106. If you have multiple FM demodulation hardware options, the hardware that will be used is automatically selected in order of priority (with firmware revision A.14.00 and later).

1. Option 106 - Bluetooth™ [1]
2. Option AYQ - Quasi-peak detection and FM demodulation
3. Option BAA - FM Demodulation

Factory Preset and *RST: AM

Front Panel Access: Det/Demod, Demod, AM

Det/Demod, Demod, FM

FM Deviation

[:SENSe]:DEMod:FMDeviation <freq>

[:SENSe]:DEMod:FMDeviation?

Sets the total FM frequency deviation for displaying the demodulation. FM Deviation can only be changed if you have Options BAA or AYQ installed. For Option 106, only the query form of the command is applicable.

If you have multiple FM demodulation hardware options, the hardware that will be used is automatically selected in order of priority (with firmware revision A.14.00 or later).

1. Option 106 - Bluetooth™
2. Option AYQ - Quasi-peak detection and FM demodulation
3. Option BAA - FM Demodulation

Factory Preset and *RST: 100 kHz for Option BAA, AYQ

Approximately 40 kHz for Option 106 (determined during FM demodulation alignment)

1. Bluetooth is a trademark owned by its proprietor and used by Agilent Technologies under license.

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Range: 5 kHz to 1.2 MHz

NOTE If 1.0 MHz is entered as the deviation frequency, peak to peak would be 1 MHz times 2 = 2.0 MHz or 200 kHz/division.

Default Unit: Hz

History: Modified with firmware revision A.14.00.

Front Panel Access: AMPLITUDE, Scale/Div

FM Demodulation Squelch

[:SENSe]:DEMod:SQUelch <integer>

[:SENSe]:DEMod:SQUelch?

Allows you to adjust the squelch level. The squelch level mutes weak signals and passes strong signals. Only the audio level is affected. If the internal speaker is On, audio signals are not output unless the signal strength exceeds the squelch threshold. This function is only available when Option AYQ is used as the instrument FM demodulation hardware.

The squelch level does not affect the rear panel AUX VIDEO OUT signal. Squelch level is indicated on screen by the numbers 0 to 100, with 0 being the minimum threshold (all signals are passed) and 100 being the maximum threshold (no signals are passed). The default squelch value is 0.

Factory Preset and *RST: 0

Range: 0 to 100

History: Added with firmware revision A.14.00.

Front Panel Access: Det/Demod, Demod

Demodulation Control

[:SENSe]:DEMod:STATe OFF|ON|0|1

[:SENSe]:DEMod:STATe?

Turns demodulation on or off.

Factory Preset and *RST: Off

Front Panel Access: Det/Demod, Demod, Off

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Demod Time

[:SENSe]:DEMod:TIME <time>

[:SENSe]:DEMod:TIME?

Sets the time used for frequency domain demodulation.

Factory Preset and *RST: 500 ms

Range: 2 ms to 100 s

Default Unit: seconds

Front Panel Access: Det/Demod, Demod, Demod Time

Demod View

[:SENSe]:DEMod:VIEW[:STATe] OFF|ON|0|1

[:SENSe]:DEMod:VIEW[:STATe]?

This command is only available if FM demodulation is selected. It causes the demodulated signal to be displayed with the y-axis scale in units of kHz. Use `:DISPlay:WINDow:TRACe:Y:SCALe:PDIVision:FREQuency` to set scale/div.

If FM Demod is on, then several functions are not available. These include: Log/Lin (display is always in linear), Y-Axis Units, Marker Search functions, Normalize, Display Line, Peak Excursion, and Peak Threshold. These functions are not affected when AM demodulation is selected.

Factory Preset and *RST: Off

Remarks: This command is not available when Demod is set to Off.

History: Added with firmware revision A.14.00.

Front Panel Access: Det/Demod, Demod, FM, Demod View

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[:SENSe]:DETector Subsection

Automatic Detection Type Selected

[:SENSe]:DETector:AUTO OFF|ON|0|1

[:SENSe]:DETector:AUTO?

Switches automatically to the optimum detection type for typical measurements using the current instrument settings.

The detector type is average if any of these are on:

- Noise marker
- Band power markers
- Trace averaging when the Average Type is Power (RMS).

The detector type is sample if any of the following conditions are true:

- Trace averaging is on with average type of video
- Both max and min hold trace modes are on
- Resolution bandwidth is less than 1 kHz, and noise marker, band power markers, or trace averaging is on
- Quasi-peak detection (Option AYQ)
- EMI Average detection (Option AYQ)

The detector type is negative peak if any trace is in min hold and no traces are in max hold.

The detector type is peak if the above conditions are off.

Manually changing the detector function turns Auto off.

Refer to Figure 2-1 on page 55, which shows a decision tree of how detection type is determined.

Factory Preset and *RST: On

History: Added with firmware revision A.08.00. Modified with A.14.00.

Front Panel Access: **Det/Demod**, **Detector**

Type of Detection

[:SENSe]:DETector[:FUNCtion]
NEGative|POSitive|SAMPle|AVERage|RMS

[:SENSe]:DETector[:FUNCtion]?

Specifies the detection mode. For each trace interval (bucket), average detection

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displays the average of all the samples within the interval. The averaging can be done using two methods:

the power method (RMS)
the video method (Y Axis Units)

The method is controlled by the BW/Avg, Avg Type key.

NOTE The combination of the average detector and the power average type is equivalent to what is sometimes referred to as “RMS detection.”

- Negative peak detection displays the lowest sample taken during the interval being displayed.
- Positive peak detection displays the highest sample taken during the interval being displayed.
- Sample detection displays the sample taken during the interval being displayed, and is used primarily to display noise or noise-like signals. In sample mode, the instantaneous signal value at the present display point is placed into memory. This detection should not be used to make the most accurate amplitude measurement of non noise-like signals.
- Average detection is used when measuring the average value of the amplitude across each trace interval (bucket). The averaging method used by the average detector is set to either video or power as appropriate when the average type is auto coupled.

Factory Preset and *RST: Positive

History: Added Average and RMS elements to the command with firmware revision A.08.00.

Front Panel Access: **Det/Demod**, **Detector**
Det/Demod, **Detector**, **Peak**
Det/Demod, **Detector**, **Sample**
Det/Demod, **Detector**, **Negative Peak**
Det/Demod, **Detector**, **Average**

Type of EMI Detection

`[:SENSe]:DETector[:FUNCtion]:EMI QPEak|AVERage|OFF`

`[:SENSe]:DETector[:FUNCtion]:EMI?`

Specifies the specified type of EMI detection. Selecting either quasi peak or EMI average runs an amplitude ranging process that affects the reference level and attenuation settings. This optimizes the available dynamic range for the measurement. Choosing these detector also gives you access to the view and quasi-peak gain functions.

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QPEak - The quasi peak detector weights the peak-detected amplitude using specific charge, discharge, and meter time constants. The effect of this detector depends on the characteristics and repetition rate of the input signal. When the quasi-peak detector is selected, the analyzer is forced to linear amplitude display using sample detection.

AVERage - The EMI average detector averages the peak detection amplitude. When EMI average detection is selected, the analyzer is forced to linear amplitude display using sample detection.

OFF - Turning EMI detectors off restores the amplitude reference level and scale type (logarithmic or linear) that was used prior to the selection of either the quasi-peak or average detector.

Factory Preset and *RST: Off

Couplings/ Dependencies: When the EMI detector is Off, the `SENSe:DETector:FUNCtion:EMI:VIEW` and `SENSe:POWer:QPGain:STATe` functions are not available.

Remarks: This command is only available with Option AYQ installed.

History: Added with firmware revision A.14.00.

Front Panel Access: **Det/Demod**, **EMI Detector**
Det/Demod, **EMI Detector**, **Quasi Peak**
Det/Demod, **EMI Detector**, **EMI Average**
Det/Demod, **EMI Detector**, **Off**

View of EMI Detection

`[:SENSe]:DETector[:FUNCtion]:EMI:VIEW POSitive|EMI`

`[:SENSe]:DETector[:FUNCtion]:EMI:VIEW?`

Selects between positive peak detection and the EMI quasi-peak/average detection, without changing the ranging which adjusts the reference level. This allows you to use peak detection while maintaining the current EMI measurement settings/view.

Factory Preset and *RST: Off

Couplings/ Dependencies: This function is not available unless you have selected `SENSe:DETector:FUNCtion:EMI QPEak or AVERage`.

Remarks: This command is only available with Option AYQ installed.

History: Added with firmware revision A.14.00.

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Front Panel Access: **Det/Demod**, **EMI Detector**

Immediate Auto-Range EMI Detector

`[:SENSe]:DETector:RANGe:IMMediate`

Re-runs the amplitude ranging process. This optimizes the available dynamic range for measurements using the EMI quasi-peak and average detectors. See also `SENSe:DETector:FUNCtion:EMI`.

Remarks: This command is only available with Option AYQ installed.

History: Added with firmware revision A.14.00.

Auto-Range EMI Detector

`[:SENSe]:DETector:RANGe[:STATe] OFF|N|0|1`

`[:SENSe]:DETector:RANGe[:STATe]?`

Turns on/off the amplitude ranging process. This process optimizes the available dynamic range for measurements using the EMI quasi-peak and average detectors and is usually done automatically each time one of these detector types is selected. This turns off the auto-ranging behavior. See also `SENSe:DETector:FUNCtion:EMI`.

Factory Preset and *RST: On

Remarks: This command is only available with Option AYQ installed.

History: Added with firmware revision A.14.00.

Remove EMI Auto-Range

`[:SENSe]:DETector:UNRange`

Returns the instrument settings for reference level and attenuation to the values they were before the last auto-ranging command was sent. The amplitude auto-ranging process optimizes the available dynamic range for measurements using the EMI quasi-peak and average detectors. See `SENSe:DETector:RANGe:IMMediate`.

Remarks: This command is only available with Option AYQ installed.

History: Added with firmware revision A.14.00.

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[:SENSe]:FREQuency Subsection

Center Frequency

[:SENSe]:FREQuency:CENTer <freq>

[:SENSe]:FREQuency:CENTer UP|DOWN

[:SENSe]:FREQuency:CENTer?

Set the center frequency.

NOTE In log sweep mode, the minimum start frequency is 10 Hz.

Factory Preset and *RST: ESA E4401B, E4411B: 750 MHz
ESA E4402B, E4403B: 1.5 GHz
ESA E4404B: 3.35 GHz
ESA E4405B: 6.6 GHz
ESA E4407B, E4408B: 13.25 GHz

Range: ESA E4401B, E4411B: –80 MHz[1] to 1.58 GHz
ESA E4402B, E4403B: –80 MHz[1] to 3.10 GHz
ESA E4404B: –80 MHz[1] to 6.78 GHz
ESA E4405B: –80 MHz[1] to 13.3 GHz
ESA E4407B, E4408B: –80 MHz[1] to 27.0 GHz

Default Unit: Hz

Front Panel Access: **FREQUENCY/Channel, Center Freq**

Center Frequency Step Size Automatic

[:SENSe]:FREQuency:CENTer:STEP:AUTO OFF|ON|0|1

[:SENSe]:FREQuency:CENTer:STEP:AUTO?

Specifies whether the step size is set automatically based on the span.

Factory Preset and *RST: On

1. 10 Hz minimum in log sweep mode.

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Front Panel Access: **FREQUENCY/Channel, CF Step Auto Man**

Center Frequency Step Size

[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>

[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?

Specifies the center frequency step size.

Factory Preset and *RST: Span/10

Range: Maximum negative frequency to the maximum positive frequency listed below:

ESA E4401B, E4411B: –1.58 to 1.58 GHz

ESA E4402B, E4403B: –3.10 to 3.10 GHz

ESA E4404B: –6.78 to 6.78 GHz

ESA E4405B: –13.3 to 13.3 GHz

ESA E4407B, E4408B: –27.0 to 27.0 GHz

Default Unit: Hz

Front Panel Access: **FREQUENCY/Channel, CF Step Man**

Frequency Span

[:SENSe]:FREQuency:SPAN <freq>

[:SENSe]:FREQuency:SPAN?

Set the frequency span. Setting the span to 0 Hz puts the analyzer into zero span.

Factory Preset and *RST: ESA E4401B, E4411B: 1.5 GHz

ESA E4402B, E4403B: 3.0 GHz

ESA E4404B: 6.7 GHz

ESA E4405B: 13.2 GHz

ESA E4407B, E4408B: 26.5 GHz

Range: ESA E4401B, E4411B: 0 Hz, 100 Hz to 1.58 GHz

ESA E4402B, E4403B: 0 Hz, 100 Hz to 3.10 GHz

ESA E4404B: 0 Hz, 100 Hz to 6.78 GHz

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ESA E4405B: 0 Hz, 100 Hz to 13.3 GHz

ESA E4407B, E4408B: 0 Hz, 100 Hz to 27.0 GHz

Default Unit: Hz

Front Panel Access: **SPAN/X Scale, Span**

SPAN/X Scale, Zero Span

Full Frequency Span

`[:SENSe]:FREQuency:SPAN:FULL`

Set the frequency span to full scale.

Factory Preset and *RST: ESA E4401B, E4411B: 1.5 GHz

ESA E4402B, E4403B: 3.0 GHz

ESA E4404B: 6.7 GHz

ESA E4405B: 13.2 GHz

ESA E4407B, E4408B: 26.5 GHz

Front Panel Access: **SPAN/X Scale, Full Span**

Last Frequency Span

`[:SENSe]:FREQuency:SPAN:PREVious`

Set the frequency span to the previous span setting.

Front Panel Access: **SPAN/X Scale, Last Span**

Start Frequency

`[:SENSe]:FREQuency:STARt <freq>`

`[:SENSe]:FREQuency:STARt?`

Set the start frequency.

NOTE In log sweep mode, the minimum start frequency is 10 Hz.

Factory Preset

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and *RST:	0 Hz
Range:	ESA E4401B, E4411B: –80 MHz[1] to 1.58 GHz
	ESA E4402B, E4403B: –80 MHz[1] to 3.10 GHz
	ESA E4404B: –80 MHz[1] to 6.78 GHz
	ESA E4405B: –80 MHz[1] to 13.3 GHz
	ESA E4407B, E4408B: –80 MHz[1] to 27.0 GHz
Default Unit:	Hz
Front Panel Access:	**FREQUENCY/Channel, Start Freq**

Stop Frequency

`[:SENSe]:FREQuency:STOP <freq>`

`[:SENSe]:FREQuency:STOP?`

Set the stop frequency.

Factory Preset and *RST:	ESA E4401B, E4411B: 1.5 GHz
	ESA E4402B, E4403B: 3.0 GHz
	ESA E4404B: 6.7 GHz
	ESA E4405B: 13.2 GHz
	ESA E4407B, E4408B: 26.5 GHz
Range:	ESA E4401B, E4411B: –80 MHz[2] to 1.58 GHz
	ESA E4402B, E4403B: –80 MHz[2] to 3.10 GHz
	ESA E4404B: –80 MHz[2] to 6.78 GHz
	ESA E4405B: –80 MHz[2] to 13.3 GHz
	ESA E4407B, E4408B: –80 MHz[2] to 27.0 GHz
Default Unit:	Hz
Front Panel Access:	**FREQUENCY/Channel, Stop Freq**

1. 10 Hz minimum in log sweep mode.
2. 10 Hz minimum in log sweep mode.

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Frequency Synthesis Mode

[:SENSe]:FREQuency:SYNThesis 1|2|3

[:SENSe]:FREQuency:SYNThesis?

This command switches between two phase noise optimization modes. Mode 2 optimizes the analyzer for close-in phase noise. Mode 3 optimizes the analyzer for tuning speed. Mode 1 is not recommended for new designs.

This command is available for the following models only:

E4402B, E4403B, E4404B, E4405B, E4407B, E4408B

Factory Preset and *RST: 3

History: Added with firmware revision A.08.00.

Front Panel Access: **AUTO COUPLE, PhNoise Opt**

Frequency Synthesis State

[:SENSe]:FREQuency:SYNThesis:AUTO OFF|ON|0|1

[:SENSe]:FREQuency:SYNThesis:AUTO?

This command switches between auto and manual phase noise selection.

When in auto mode, the phase noise optimization is set as follows:

- For spans ≤ 10 MHz, the analyzer is optimized for phase noise.
- For spans > 10 MHz, the analyzer is optimized for fast tuning.

This command is available for the following models only:

E4402B, E4403B, E4404B, E4405B, E4407B, E4408B

Factory Preset and *RST: On

History: Added with firmware revision A.08.00.

Front Panel Access: **AUTO COUPLE, PhNoise Opt**

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[SENSe]:MIXer Subsection

Select External Mixer Band

[:SENSe]:MIXer:BAND K|A|Q|U|V|E|W|F|D|G|Y|J|USER

[:SENSe]:MIXer:BAND?

This command allows the selection of one of the pre-defined bands corresponding to the external mixer currently in use. This command is available only with Option AYZ (External Mixing).

Factory Preset and *RST: Band A (26.5-40 Ghz)

Remarks: If the mixer harmonic configuration (**[:SENSe]:MIXer:HARMonic:AUTO OFF|ON|0|1** is set to Off (manual), then a query will return "**USER**".

NOTE Bands K, E, W, F, D, G, Y, and J are not available if Mixer Type is set to Presel.

Front Panel Access: **Input/Output (or Input), Input Mixer, Ext Mix Band**

External Mixer Bias Adjust

[:SENSe]:MIXer:BIAS <numeric>

[:SENSe]:MIXer:BIAS?

This command allows the adjustment of an internal bias source for use with external mixers. This command is available only with Option AYZ (External Mixing).

Factory Preset and *RST: 0

Range: –10 mA to 10 mA

Default Unit: mA

Remarks: The bias signal is present on the center conductor of the IF INPUT connector on the front panel. See related command **[:SENSe]:MIXer:BIAS[:STATe] OFF|ON|0|1**.

NOTE Mixer Bias will be set to Off when transitioning from manual harmonic mode to auto harmonic mode.

Front Panel Access: **Input/Output (or Input), Input Mixer, Mixer Config, Mixer Bias On Off**

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Set External Mixer Bias On/Off

`[:SENSe]:MIXer:BIAS:STATe OFF|ON|0|1`

`[:SENSe]:MIXer:BIAS:STATe?`

This command activates an internal bias source for use with external mixers. This command is available only with Option AYZ (External Mixing).

Factory Preset and *RST: Off

Remarks: The bias signal is present on the center conductor of the IF Input connector on the front panel. See related command **`[:SENSe]:MIXer:BIAS <numeric>`**.

NOTE Mixer Bias will be set to Off when transitioning from manual harmonic mode to auto harmonic mode.

Front Panel Access: **Input/Output (or Input), Input Mixer, Mixer Config, Mixer Bias On Off**

Set External Mixer LO Harmonic Value

`[:SENSe]:MIXer:HARMonic <integer>`

`[:SENSe]:MIXer:HARMonic?`

This command allows you to set the LO harmonic value for mixers other than the HP/Agilent 11970-Series or 11974-Series Mixers. This is done after the mixer harmonic configuration (**`[:SENSe]:MIXer:HARMonic:AUTO OFF|ON|0|1`**) is set to Off (manual). This command is available only with Option AYZ (External Mixing).

Factory Preset and *RST: –8 (Band A, 26.5-40 GHz)

Range: Any non-zero integer from –50 to 50, inclusive

Remarks: The harmonic value with its associated sign is automatically determined from the external mixer band selected. This is the AUTO mode. For mixers other than the HP/Agilent 11970-Series or 11974-Series, an LO harmonic other than that determined in the AUTO mode may be required. This is achieved using this command and related command **`[:SENSe]:MIXer:HARMonic:AUTO OFF|ON|0|1`**.

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Set External Mixer LO Harmonic Mode

`[:SENSe]:MIXer:HARMonic:AUTO OFF|ON|0|1`

`[:SENSe]:MIXer:HARMonic:AUTO?`

This command allows you to set the external mixer LO harmonic mode to either automatic or manual. The manual mode is used with mixers other than the HP/Agilent 11970-Series or 11974-Series Mixers to manually choose the required LO harmonic. This command is available only with Option AYZ (External Mixing).

Refer also to commands **`:INPut:MIXer INTernal|EXTernal`** and **`:INPut:MIXer:TYPE PRESelected|UNPReselect`**.

Factory Preset and *RST: AUTO

Remarks: The harmonic value with its associated sign is automatically determined from the external mixer band selected. This is the AUTO mode. For mixers other than the HP/Agilent 11970-Series or 11974-Series, an LO harmonic other than that determined in the AUTO mode may be required. This is achieved using this command and related command **`[:SENSe]:MIXer:HARMonic <value>`**.

NOTE Manually selecting a harmonic will remove any restrictions on Mixer Bias and Mixer Type, and External Mixer Band will become USER. Returning the Harmonic to AUTO will reset the band to A, set Mixer Type to UNPReselect, and turn Mixer Bias Off.

Front Panel Access: **Input/Output (or Input), Input Mixer, Mixer Config, Harmonic Auto Man**

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[:SENSe]:POWer Subsection

Quasi-peak Detector Gain

[:SENSe]:POWer:QPGain[:STATe] OFF|ON|0|1

[:SENSe]:POWer:QPGain[:STATe]?

Turns on or off the linear ×10 gain stage in the quasi-peak and average detector signal path. This stage may be enabled/disabled whenever the quasi-peak or EMI average detector is first selected. See SENSe:DETector:FUNCtion:EMI.

Factory Preset and *RST: Off

Remarks: This command is only available with Option AYQ installed.

Front Panel Access: **Det/Demod**, **EMI Detector**

Input Attenuation

[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>

[:SENSe]:POWer[:RF]:ATTenuation?

Set the input attenuator. This value is set at its auto value if input attenuation is set to auto.

Factory Preset and *RST: 10 dB

Range: ESA E4401B, E4411B: 0 to 60 dB

ESA E4402B, E4403B, E4404B, E4405B: 0 to 75 dB

ESA E4407B, E4408B: 0 to 65 dB

Default Unit: dB

Front Panel Access: **AMPLITUDE/Y Scale, Attenuation Auto Man**

Input Port Attenuator Auto

[:SENSe]:POWer[:RF]:ATTenuation:AUTO OFF|ON|0|1

[:SENSe]:POWer[:RF]:ATTenuation:AUTO?

Select the input port attenuator range to be set either automatically or manually.

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On – Input attenuation is automatically set as determined by the Reference Level Setting.

Off – Input attenuation is manually set

Factory Preset and *RST: On

Front Panel Access: **AMPLITUDE Y Scale, Attenuation**

Input Port Power Gain

[:SENSe]:POWer[:RF]:GAIN[:STATe] OFF|ON|0|1

[:SENSe]:POWer[:RF]:GAIN[:STATe]?

Turns the internal preamp on or off.

Factory Preset and *RST: Off

Remarks: This command is only available with Option 1DS installed.

Front Panel Access: **AMPLITUDE/Y Scale, Int Preamp On Off**

Input Port Maximum Mixer Power

[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer] <ampl>

[:SENSe]:POWer[:RF]:MIXer:RANGe[:UPPer]?

Specifies the maximum power at the input mixer.

Factory Preset and *RST: –10 dBm

Range: –100 dBm to 10 dBm

Default Unit: dBm

Front Panel Access: **AMPLITUDE/Y Scale, Max Mixer Lvl**

Optimize Preselector Frequency

[:SENSe]:POWer[:RF]:PADJust <freq>

[:SENSe]:POWer[:RF]:PADJust?

This command allows user-defined adjustment of the preselector frequency to

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optimize its response on the signal of interest.

Factory Preset and *RST: 0 Hz

Range: –250 MHz to 250 MHz

Default Unit: None. Use the MHz terminator in order for this command to work.

Remarks: This command is available only on Agilent ESA models E4404B, E4405B, E4407B, and E4408B. Use this command for signals close to the noise level, multiple signals close together, or for other conditions when the preselector is not tuned to the frequency of interest.

Front Panel Access: **AMPLITUDE/Y Scale, Presel Adjust**

Preselector Center

`[:SENSe]:POWer[:RF]:PCENter`

In internal mixing, this command centers the preselector filter at the signal of interest. In external mixing, the external preselector filter is adjusted to the peak of the filter response to maximize the amplitude at the active marker frequency. This command has no effect if it is activated in non-preselected bands. This command is usable from 3 GHz to the maximum frequency of the analyzer.

NOTE This command is available only on Agilent ESA models E4404B, E4405B, E4407B, and E4408B. This command has no effect with markers set to less than 3 GHz.

Remarks: A peak search will be done if no marker is on.

Front Panel Access: **AMPLITUDE/Y Scale, Presel Center**

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[:SENSe]:SIDentify Subsection

Set Mixer Signal Identification Mode

[:SENSe]:SIDentify:MODE ISUPpress|ISHift

[:SENSe]:SIDentify:MODE?

This command lets you choose one of two types of signal identification methods when viewing multiple responses from non-preselected external mixers. This command is available only with Option AYZ (External Mixing). Refer to **:INPut:MIXer:TYPE** to select the type of mixer being used.

Factory Preset and *RST: ISUPpress

History: Added with firmware revision A.03.00.

Front Panel Access: **Input/Output (or Input), Input Mixer, Signal ID Mode, Image Suppress**

Input/Output (or Input), Input Mixer, Signal ID Mode, Image Shift

Set Mixer Signal Identification State

[:SENSe]:SIDentify[:STATe] OFF|ON|0|1

[:SENSe]:SIDentify[:STATe]?

This command activates an algorithm which either removes or aids with the identification of multiple responses. These responses are generated from a single input signal using non-preselected external mixers.

Factory Preset and *RST: Off

History: Added with firmware revision A.03.00.

Remarks: Signal identification relies on the acquisition of data from two successive sweeps. Therefore, if the analyzer is in single sweep mode, two sweep triggers are needed to generate the sweep pair. In image suppress mode, synchronization is ensured by first turning off signal identification, initiating a single sweep, then turning on signal identification followed by two single sweeps.

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To synchronize in image shift mode, turn off signal identification, initiate a single sweep, and turn on signal identification. The results of the first sweep after signal identification is turned on must be ignored. The data from the second sweep is available in Trace 1 and the data from the third (shifted) sweep is available in Trace 2.

NOTE Signal identification is not available with signal track, resolution bandwidths ≤300 Hz, demod, or averaging. Signal identification will be turned off when input mixer is set to internal.

Front Panel Access: **Input/Output (or Input), Input Mixer, Signal Ident On Off**

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[:SENSe]:SWEep Subsection

Sweep Points

[:SENSe]:SWEep:POINts <number of points>

[:SENSe]:SWEep:POINts?

This command sets the number of sweep points.

Factory Preset and *RST: 401

Example: **:SWEep:POIN 401**

History: This command is available only on analyzers with firmware revision A.04.00 and later. Analyzers with firmware revisions prior to A.04.00 have the number of sweep points fixed at 401.

Range: 101 to 8192, (2 to 8192 in zero span for analyzers with firmware revision A.05.00 and later)

Remarks: The number of sweep points can be set only with Agilent ESA models E4401B, E4402B, E4404B, E4405B, and E4407B. Sweep points for ESA models E4403B, E4408B, and E4411B are fixed at 401 points. The number of sweep points may be queried on all analyzers with firmware revision A.04.00 and later.

For analyzers with firmware revisions prior to A.08.00, any change to sweep points sets the following commands as shown:

:CALCulate:LLINe1:DISPlay to off, and
:CALCulate:LLINe2:DISPlay to off.

Whenever the number of sweep points change, the following functions are affected:

- All trace data is erased
- Any traces in view mode will go to blank mode
- Sweep time is re-calculated
- Any limit lines that are on will be turned off (For analyzers with firmware revisions prior to A.08.00)

Front Panel Access: **Sweep, Points**

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Query Number of Segments

[:SENSe]:SWEep:SEGMent:COUNt?

Returns the number of segments that have been defined in the segmented sweep data.

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

Factory Preset and *RST: 0

Range: 0 to 32

Set All Segment Data

[:SENSe]:SWEep:SEGMent:DATA[:ALL] <SSTop|CSPan>,<string>

[:SENSe]:SWEep:SEGMent:DATA[:ALL]? <SSTop|CSPan>

Specify parameters for all segments of a segmented sweep. The data is entered as comma-separated ASCII values in sequential order of segments desired. Segments will be sorted in order of increasing start frequency. If multiple segments have the same start frequency, they will appear in order of increasing stop frequency. It is possible to define segments that overlap.

For SSTop, the data order used for each segment is: start frequency, stop frequency, resolution bandwidth, video bandwidth, number of points, and sweep time.

For CSPan, the data order used for each segment is: center frequency, span, resolution bandwidth, video bandwidth, number of points, and sweep time.

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, or E4407B.

NOTE Command **[:SENSe]:SWEep:SEGMent:DATA[:ALL]** will delete any previous segment data.

Example:
```
:SENSe:SWEep:SEGMent:DATA:ALL
CSPan,50e06,5e6,1e5,1e5,101,.0050,1e09,5e6
,1e5,1e5,101,.05
```

This example defines two segments. The first segment has a center frequency of 50 MHz and the second segment has a center frequency of 1 GHz.

Range: The range depends upon the model number, installed options, and firmware revision of your instrument; see the Specifications Guide for details. The ranges that apply to all instrument models

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that can be controlled with this command are resolution bandwidth, video bandwidth, and number of points.

Resolution Bandwidth: 1 kHz to 5 MHz

Video Bandwidth: 30 Hz to 3 MHz

Number of Points: 101 to 8192, 2 to 8192 in zero span. The total number of points for all segments is ≤ 8192 .

Default Unit: Fundamental units (without entering the actual units)

Front Panel Access: **Sweep, Segmented, Modify, Edit, Center Freq**

Sweep, Segmented, Modify, Edit, Span

Sweep, Segmented, Modify, Edit, Resolution BW

Sweep, Segmented, Modify, Edit, Video BW

Sweep, Segmented, Modify, Edit, Points

Sweep, Segmented, Modify, Edit, Sweep Time

Merge Data With Segmented Sweep Data

`[:SENSe]:SWEep:SEGMent:DATA:MERGe <SSTop|CSPan>,<string>`

Merges the data to the segmented sweep data. Segments will be sorted in order of increasing start frequency. If multiple segments have the same start frequency, they will appear in order of increasing stop frequency. It is possible to define segments that overlap.

For SSTop, the data order used for each segment is: start frequency, stop frequency, resolution bandwidth, video bandwidth, number of points, and sweep time.

For CSPan, the data order used for each segment is: center frequency, span, resolution bandwidth, video bandwidth, number of points, and sweep time.

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

Example: **`:SENSe:SWEep:SEGMent:DATA:MERGe CSPan,150e06,5e6,1e5,1e5,101,.050,110e06,5e6,1e5,1e5,100,.05`**

This example merges two segments into the segmented sweep table. The first segment has a center frequency of 150 MHz and the second segment has a center frequency of 110 MHz.

Range: The range depends upon the model number, installed options, and firmware revision of your instrument; see the Specifications Guide for details. The ranges that apply to all instrument models

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that can be controlled with this command are resolution bandwidth, video bandwidth, and number of points.

Resolution Bandwidth: 1 kHz to 5 MHz

Video Bandwidth: 30 Hz to 3 MHz

Number of Points: 101 to 8192, 2 to 8192 in zero span. The total number of points for all segments is ≤ 8192 .

Default Unit: Fundamental units (without entering the actual units)

Delete All Segmented Sweep Data

`[:SENSe]:SWEep:SEGMent:DELete`

Deletes all segmented sweep data.

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

Front Panel Access: **Sweep, Segmented, Modify, Delete**

Delete Some Segmented Sweep Data

`[:SENSe]:SWEep:SEGMent:DELete:ROW <integer>`

Deletes only the specified segmented sweep data (row).

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

Range: 1 to maximum number of segments

Front Panel Access: **Sweep, Segmented, Modify, Edit, Delete Segment**

NOTE The front panel keys shown for this command deletes the active segment only. The remote command deletes any specified segment.

Turn On/Off Segmented Sweep

`[:SENSe]:SWEep:SEGMent[:STATe] OFF|ON|0|1`

`[:SENSe]:SWEep:SEGMent[:STATe]?`

Turns on or off segmented sweep. Segmented sweep is a mode where only bands

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of interest are measured with the data presented in a single trace. This improves measurement speed and provides more detail and resolution in those bands.

NOTE When segmented sweep is turned on or off, all trace data (including stored trace data) is deleted.

NOTE This command applies to the following models having firmware revision A.05.00 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

Factory Preset and *RST: Off

Remarks: Segmented sweep will be turned off if any of the following actions occur remotely or manually:

- Factory Preset
- Full Span is activated
- Last Span is activated
- On entering a measurement (**`:MEASure`** subsystem commands)

While segmented sweep is on, the following functions are unavailable:

- Auto couple
- BW/Avg: RBW, VBW
- Center/Start/Stop frequency, CF Step, and frequency Offset
- Span, sweep time, and points

Front Panel Access: **Sweep, Segmented, ON/OFF**

Set Frequency Domain Scale Type

`[:SENSe]:SWEep:SPACing LINear|LOGarithmic`

`[:SENSe]:SWEep:SPACing?`

Selects either linear or logarithmic for the frequency domain (X-axis) scale. The trace query of comma-separated values maps frequency/amplitude pairs for the mathematical interpolation of the log frequency axis. The value of **`[:SENSe]:SWEep:POINts`** is adjusted to reflect the acquisition of data for the given sweep span when log sweep spacing is enabled.

NOTE This command applies to the following models having firmware revision A.08.02 or later: E4401B, E4402B, E4404B, E4405B, E4407B.

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Factory Preset and *RST: Linear

Remarks: Refer to the User's Guide for detailed information on the interactions of this command with other functions.

History: Added with firmware revision A.08.00.

Front Panel Access: **FREQUENCY, Scale Type**

Sweep Time

[:SENSe]:SWEep:TIME <time>

[:SENSe]:SWEep:TIME?

Specifies the time in which the instrument sweeps the display.

Factory Preset and *RST: ESA E4401B, E4411B: 4 ms

ESA E4402B, E4403B: 5 ms

ESA E4404B: 16.75 ms

ESA E4405B: 33 ms

ESA E4407B, E4408B: 265 ms

Range: The range depends upon the installed options, number of sweep points, and firmware revision of your instrument. See "Sweep Time Range" in the Specifications Guide for details.

Default Unit: seconds

Remarks: A span value of 0 Hz causes the analyzer to enter zero span mode. In zero span the X-axis represents time rather than frequency. In this mode, the sweep time may be set to faster values when Options AYX or B7D are installed.

Front Panel Access: **Sweep, Sweep Time Auto Man**

Automatic Sweep Time

[:SENSe]:SWEep:TIME:AUTO OFF|ON|0|1

[:SENSe]:SWEep:TIME:AUTO?

Automatically selects the fastest sweep time for the current settings.

Factory Preset and *RST: On

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History: This command function changed with firmware revision A.08.00. With :AUTO ON in zero span, an error will be generated.

Front Panel Access: **Sweep, Sweep Time Auto Man**

Sweep Time Mode

[:SENSe]:SWEep:TIME:AUTO:MODE SRESponse|SANalyzer

[:SENSe]:SWEep:TIME:AUTO:MODE?

Specifies the type of automatic coupling for the fastest sweep time at the current settings.

Stimulus response

Spectrum analyzer

Factory Preset and *RST: SANalyzer

Front Panel Access: **Sweep, Sweep Coupling SR SA**

Time Gating Delay (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:DELay <time>

[:SENSe]:SWEep:TIME:GATE:DELay?

Sets the delay time from when the gate trigger occurs to when the gate opens. This is for **EDGE** triggering only.

Factory Preset and *RST: 1 µs

Range: 0.3 µs to 429 seconds

Default Unit: seconds

Front Panel Access: **Sweep, Gate Setup, Edge Setup, Gate Delay**

Time Gate Length (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:LENGth <time>

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[:SENSe]:SWEep:TIME:GATE:LENGth?

Specifies the gate time length in seconds; for **EDGE** triggering only.

Factory Preset and *RST: 1 µs

Range: 0.3 µs to 429 seconds

Default Unit: seconds

Front Panel Access: **Sweep, Gate Setup, Edge Setup, Gate Length**

Time Gate Level (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:LEVel HIGH|LOW

[:SENSe]:SWEep:TIME:GATE:LEVel?

Selects the level of the gate signal; this command is for LEVel triggering only.

Factory Preset and *RST: High

Front Panel Access: **Sweep, Gate Setup, Level Setup**

Time Gate Polarity (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:POLarity NEGative|POSitive

[:SENSe]:SWEep:TIME:GATE:POLarity?

Selects the polarity of the gate signal; this command is for EDGE triggering only.

Factory Preset and *RST: Positive

Front Panel Access: **Sweep, Gate, Edge Gate, Slope Pos Neg**

Preset Time Gate (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:PRESet

Presets the time-gated spectrum analysis capability.

Remarks: This command resets gate parameters to default values:

Gate trigger type = edge

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Gate polarity = positive

Gate delay = 1 µs

Gate length = 1 µs

Gate level = high

Control Time Gate (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE[:STATe] OFF|ON|0|1

[:SENSe]:SWEep:TIME:GATE[:STATe]?

Turns time gating on or off.

NOTE Time gate cannot be turned on if external trigger delay is on.

Factory Preset and *RST: Off

Front Panel Access: **Sweep, Gate, Gate On Off**

Time Gate Trigger Type (Option 1D6 Only)

[:SENSe]:SWEep:TIME:GATE:TYPE LEVel|EDGE

[:SENSe]:SWEep:TIME:GATE:TYPE?

Selects between edge and level mode for time-gated spectrum analysis.

Level triggers the gate when the signal surpasses a specific level, set to either low or high.

Edge triggers the gate when the edge of a signal is encountered, set to either a negative-going edge or a positive-going edge.

Factory Preset and *RST: Edge

Front Panel Access: **Sweep, Gate, Gate Control Edge Level**

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SOURce Subsystem

The SOURce subsystem controls the signal characteristics of the tracking generator. Refer also to the "OUTPut Subsystem" on page 300 which contains a command that controls the tracking generator output.

Sets the Output Power Offset Correction

:SOURce:CORRection:OFFSet <rel_ampl>

:SOURce:CORRection:OFFSet?

Specifies an offset for the displayed output power level. An offset power level can be added to the displayed level to compensate for system losses (for example, cable loss) or gains (for example, preamplifier gain.) This offset does not change the power out of the source, it only changes the display so that it reads out the actual power delivered to the device under test.

Factory Preset and *RST: 0 dB

Range: –327.6 dB to 327.6 dB

Default Unit: Currently selected source power units

Front Panel Access: **Source, Amptd Offset**

Source Attenuation

:SOURce:POWer:ATTenuation <ampl>

:SOURce:POWer:ATTenuation?

Attenuates the source output level. Specifically setting **:SOURce:POWer:ATTenuation <ampl>** sets the mode to manual (**:SOURce:POWer:ATTenuation:AUTO OFF**).

Factory Preset and *RST:
ESA E4401B, E4411B: 0 dB
ESA E4402B, E4403B: 8 dB
ESA E4404B: 8 dB
ESA E4405B: 8 dB
ESA E4407B, E4408B: 8 dB

Range:
ESA E4401B, E4411B: 0 dB to 60 dB in 10 dB steps
ESA E4402B, E4403B: 0 dB to 56 dB in 8 dB steps
ESA E4404B: 0 dB to 56 dB in 8 dB steps

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ESA E4405B: 0 dB to 56 dB in 8 dB steps

ESA E4407B, E4408B: 0 dB to 56 dB in 8 dB steps

Default Unit: dB

Front Panel Access: **Source, Attenuation Auto Man**

Automatic Source Attenuation

:SOURce:POWer:ATTenuation:AUTO OFF|ON|0|1

:SOURce:POWer:ATTenuation:AUTO?

Selects if the source output level attenuator will be set automatically, or manually.

Factory Preset and *RST: On

Front Panel Access: **Source, Attenuation Auto Man**

Sets the Output Power

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <ampl>

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] UP|DOWN

:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Specifies the source output power level. Use :SOURce:POWer:SWEep to set the change in power level across the sweep. Also see :SOURce:POWer:STARt and OUTPut[:STATe].

CAUTION Power-level sensitive devices connected to the tracking generator output may be accidentally damaged. This is because the actual source amplitude will be greater than the amplitude indicated on the analyzer, when the power sweep function is being used.

The source amplitude value is used as the starting amplitude for a power sweep. The ending amplitude for a power sweep is higher then the source amplitude value and it may actually be set to values beyond specified output levels. Therefore, exercise caution when connecting a power-level sensitive device to the tracking generator output.

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Factory Preset and *RST: –10 dBm

Range: ESA E4401B, E4411B with option 1DN (50 Ohm Tracking Generator): –70 dBm to 3 dBm

ESA E4401B, E4411B with Option 1DQ (75 Ohm Tracking Generator): –27.25 dBmV to 45.75 dBmV

ESA E4402B, E4403B: –66 dBm to 3 dBm

ESA E4404B: –66 dBm to 3 dBm

ESA E4405B: –66 dBm to 3 dBm

ESA E4407B, E4408B: –66 dBm to 3 dBm

Default Unit: dBm

Front Panel Access: **Source, Amplitude On Off**

Sets the Source Output Power Mode

`:SOURce:POWer:MODE FIXed|SWEep`

`:SOURce:POWer:MODE?`

Sets the source output to be at a single amplitude (fixed) or to sweep through a range of power levels.

Factory Preset and *RST: Fixed

Front Panel Access: **Source, Power Sweep On Off**

Set the Source Sweep Power Range

`:SOURce:POWer:SPAN <rel_ampl>`

`:SOURce:POWer:SPAN?`

Specifies the range of power levels through which the source output will sweep. Use **`:SOURce:POWer:STARt`** to set the power level at the start of the power sweep. This command is equivalent to **`:SOURce:POWer:SWEep.`**

Factory Preset and *RST: 0 dB

Range: 0 dB to 20 dB

Default Unit: dB

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Set the Output Power at the Start of the Sweep

:SOURce:POWer:STARt <ampl>

:SOURce:POWer:STARt?

Specifies the source output power level at the start of the power sweep. Use :**SOURce:POWer:SPAN** to set the change in power level across the sweep. This command is equivalent to **:SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]**.

CAUTION Power-level sensitive devices connected to the tracking generator output may be accidentally damaged. This is because the actual source amplitude will be greater than the amplitude indicated on the analyzer, when the power sweep function is being used.

The source amplitude value is used as the starting amplitude for a power sweep. The ending amplitude for a power sweep is higher then the source amplitude value and it may actually be set to values beyond specified output levels. Therefore, exercise caution when connecting a power-level sensitive device to the tracking generator output.

Set the Output Power to Step Automatically

:SOURce:POWer:STEP:AUTO OFF|ON|0|1

:SOURce:POWer:STEP:AUTO?

Specifies the source power step size to be one vertical scale division when in logarithmic scale, or 10 dB when in linear scale.

Factory Preset and *RST: On

Front Panel Access: **Source, Amptd Step Auto Man**

Set the Output Power Step Size

:SOURce:POWer:STEP[:INCRement] <ampl>

:SOURce:POWer:STEP[:INCRement]?

Specifies the source power step size.

Default Unit: dB

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Front Panel Access: **Source, Amptd Step Auto Man**

Set the Source Sweep Power Range

:SOURce:POWer:SWEep <rel_ampl>

:SOURce:POWer:SWEep?

Specifies the range of power levels through which the source output will sweep. Use :**SOURce:POWer:STARt** to set the power level at the start of the power sweep. See also :**SOURce:POWer:SPAN**.

Factory Preset and *RST: 0 dB

Range: 0 dB to 20 dB

Default Unit: dB

Front Panel Access: **Source, Power Sweep On Off**

Output Power Tracking

:SOURce:POWer:TRCKing <integer>

:SOURce:POWer:TRCKing?

Adjusts the tracking of the source output with the spectrum analyzer sweep in the present resolution bandwidth.

Factory Preset and *RST: This command is persistent. The term persistent means that the command retains the setting previously selected, even through a power cycle.

Range: Integer, 0 to 4095

Remarks: This command is not needed with the 1.5 GHz tracking generator.

Front Panel Access: **Source, Man Track Adj**

Output Power Tracking Peak

:SOURce:POWer:TRCKing:PEAK

Automatically adjusts the tracking of the source output with the spectrum analyzer

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sweep so that the power is maximized for the present resolution bandwidth.

Remarks: This command is not applicable for the 1.5 GHz tracking generator.

Front Panel Access: **Source, Tracking Peak**

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STATus Subsystem

The STATus subsystem controls the SCPI-defined status-reporting structures.

Operation Condition Query

:STATus:OPERation:CONDition?

This query returns the decimal value of the sum of the bits in the Status Operation Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Operation Enable

:STATus:OPERation:ENABle<integer>

:STATus:OPERation:ENABle?

This command determines which bits in the Operation Condition Register will set bits in the Operation Event register, which also sets the Operation Status Summary bit (bit 7) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE Preset sets all bits in this enable register to 0. To have any Operation Events reported to the Status Byte Register, 1 or more bits must be set to 1.

Factory Preset and *RST:	0
Range:	Integer, 0 to 32767

Operation Event Query

:STATus:OPERation[:EVENt]?

This query returns the decimal value of the sum of the bits in the Operation Event register.

NOTE The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

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Operation Negative Transition

:STATus:OPERation:NTRansition <integer>

:STATus:OPERation:NTRansition?

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: Integer, 0 to 32767

Operation Positive Transition

:STATus:OPERation:PTRansition <integer>

:STATus:OPERation:PTRansition?

This command determines which bits in the Operation Condition register will set the corresponding bit in the Operation Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Preset the Status Byte

:STATus:PRESet

Sets bits in most of the enable and transition registers to their default state. It presets all the Transition Filters, Enable Registers, and the Error/Event Queue Enable. It has no effect on Event Registers, Error/Event Queue ESE, and SRE Registers as described in IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992.

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STATus:QUEStionable Subsection

This subsection controls the SCPI-defined status-reporting structures.

Questionable Calibration Condition

:STATus:QUEStionable:CALibration:CONDition?

This query returns the decimal value of the sum of the bits in the Questionable Calibration Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Questionable Calibration Enable

:STATus:QUEStionable:CALibration:ENABle <integer>

:STATus:QUEStionable:CALibration:ENABle?

This command determines which bits in the Questionable Calibration Condition Register will set bits in the Questionable Calibration Event register, which also sets the Calibration Summary bit (bit 8) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Calibration Event Query

:STATus:QUEStionable:CALibration[:EVENt]?

This query returns the decimal value of the sum of the bits in the Questionable Calibration Event register.

NOTE The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

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Questionable Calibration Negative Transition

:STATus:QUEStionable:CALibration:NTRansition <integer>

:STATus:QUEStionable:CALibration:NTRansition?

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: Integer, 0 to 32767

Questionable Calibration Positive Transition

:STATus:QUEStionable:CALibration:PTRansition <integer>

:STATus:QUEStionable:CALibration:PTRansition?

This command determines which bits in the Questionable Calibration Condition register will set the corresponding bit in the Questionable Calibration Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Condition

:STATus:QUEStionable:CONDition?

This query returns the decimal value of the sum of the bits in the Questionable Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

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Questionable Enable

:STATus:QUEStionable:ENABle <integer>

:STATus:QUEStionable:ENABle?

This command determines which bits in the Questionable Condition Register will set bits in the Questionable Event register, which also sets the Questionable Status Summary bit (bit3) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE The preset condition is to have all bits in this enable register set to 0. To have any Questionable Events reported to the Status Byte Register, 1 or more bits need to be set to 1. The Status Byte Event Register should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer.

Factory Preset and *RST: 0

Range: Integer, 0 to 32767

Questionable Event Query

:STATus:QUEStionable[:EVENt]?

This query returns the decimal value of the sum of the bits in the Questionable Event register.

NOTE The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

Questionable Frequency Condition

:STATus:QUEStionable:FREQuency:CONDition?

This query returns the decimal value of the sum of the bits in the Questionable Frequency Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

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Questionable Frequency Enable

:STATus:QUEStionable:FREQuency:ENABle <integer>

:STATus:QUEStionable:FREQuency:ENABle?

This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Frequency Event Query

:STATus:QUEStionable:FREQuency[:EVENt]?

This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register.

NOTE

The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

Questionable Frequency Negative Transition

:STATus:QUEStionable:FREQuency:NTRansition <integer>

:STATus:QUEStionable:FREQuency:NTRansition?

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: Integer, 0 to 32767

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Questionable Frequency Positive Transition

:STATus:QUEStionable:FREQuency:PTRansition <integer>

:STATus:QUEStionable:FREQuency:PTRansition?

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Integrity Condition

:STATus:QUEStionable:INTegrity:CONDition?

This query returns the decimal value of the sum of the bits in the Questionable Integrity Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Questionable Integrity Enable

:STATus:QUEStionable:INTegrity:ENABle <integer>

:STATus:QUEStionable:INTegrity:ENABle?

This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Integrity Event Query

:STATus:QUEStionable:INTegrity[:EVENt]?

This query returns the decimal value of the sum of the bits in the Questionable Integrity Event register.

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NOTE

The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

Questionable Integrity Negative Transition

:STATus:QUEStionable:INTegrity:NTRansition <integer>

:STATus:QUEStionable:INTegrity:NTRansition?

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: Integer, 0 to 32767

Questionable Integrity Positive Transition

:STATus:QUEStionable:INTegrity:PTRansition <integer>

:STATus:QUEStionable:INTegrity:PTRansition?

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Integrity Uncalibrated Enable

:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle <integer>

:STATus:QUEStionable:INTegrity:UNCalibrated:ENABle?

This command determines which bits in the Questionable Integrity Uncalibrated Condition Register will set bits in the Questionable Integrity Uncalibrated Event register, which also sets the Data Uncalibrated Summary bit (bit 3) in the

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Questionable Integrity Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: Integer, 0 to 32767

Questionable Integrity Uncalibrated Event Query

:STATus:QUEStionable:INTegrity:UNCalibrated[:EVENt]?

This query returns the decimal value of the sum of the bits in the Questionable Integrity Uncalibrated Event register.

NOTE The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

Questionable Integrity Uncalibrated Negative Transition

:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition <integer>

:STATus:QUEStionable:INTegrity:UNCalibrated:NTRansition?

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity Uncalibrated Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: integer, 0 to 32767

Questionable Integrity Uncalibrated Positive Transition

:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition <integer>

:STATus:QUEStionable:INTegrity:UNCalibrated:PTRansition?

This command determines which bits in the Questionable Integrity Uncalibrated Condition register will set the corresponding bit in the Questionable Integrity

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Uncalibrated Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: integer, 0 to 32767

Questionable Negative Transition

:STATus:QUEStionable:NTRansition <integer>

:STATus:QUEStionable:NTRansition?

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: integer, 0 to 32767

Questionable Power Condition

:STATus:QUEStionable:POWer:CONDition?

This query returns the decimal value of the sum of the bits in the Questionable Power Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Questionable Power Enable

:STATus:QUEStionable:POWer:ENABle <integer>

:STATus:QUEStionable:POWer:ENABle?>

This command determines which bits in the Questionable Power Condition Register will set bits in the Questionable Power Event register, which also sets the Power Summary bit (bit 3) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: integer, 0 to 32767

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Questionable Power Event Query

`:STATus:QUEStionable:POWer[:EVENt]?`

This query returns the decimal value of the sum of the bits in the Questionable Power Event register.

NOTE

The register requires that the equivalent PTR or NTR filters be set before a condition register bit can set a bit in the event register.

The data in this register is latched until it is queried. Once queried, the data is cleared.

Questionable Power Negative Transition

`:STATus:QUEStionable:POWer:NTRansition <integer>`

`:STATus:QUEStionable:POWer:NTRansition?`

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when that bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 0

Range: integer, 0 to 32767

Questionable Power Positive Transition

`:STATus:QUEStionable:POWer:PTRansition <integer>`

`:STATus:QUEStionable:POWer:PTRansition?`

This command determines which bits in the Questionable Power Condition register will set the corresponding bit in the Questionable Power Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1’s)

Range: integer, 0 to 32767

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Questionable Positive Transition

`:STATus:QUEStionable:PTRansition <integer>`

`:STATus:QUEStionable:PTRansition?`

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when that bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Factory Preset and *RST: 32767 (all 1's)

Range: integer, 0 to 32767

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SYSTem Subsystem

This subsystem is used to set the controls and parameters associated with the overall system communication. These functions are not related to instrument performance.

GPIB Address

:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess <integer>

:SYSTem:COMMunicate:GPIB[1][:SELF]:ADDRess?

Sets and queries the GPIB address.

NOTE This command applies only to analyzers having Option A4H. Only one Option A4H can be installed in an instrument.

Factory Preset and *RST: It is set to 18 by **:SYSTem:PRESet:PERSistent**, which sets the persistent state values to their factory defaults.

This command is persistent. The term persistent means that the command retains the setting previously selected, even through a power cycle.

Range: Integer, 0 to 30

Front Panel Access: **System, Remote Port**

Serial Port DTR Setup

:SYSTem:COMMunicate:SERial[1]:CONTrol:DTR OFF|ON|IBFull

:SYSTem:COMMunicate:SERial[1]:CONTrol:DTR?

Sets the hardware pacing scheme. Only one Option 1AX can be installed in an instrument.

Off - holds the DTR line in the unasserted (off) condition

On - holds the DTR line in the asserted (on) condition

IBFull - selects the input buffer full mode for the DTR line. The IBFull parameter sets the DTR line to indicate when the device is ready to receive. When the number of received bytes in the input buffer of the device reaches the stop threshold, the device will unassert the DTR line. When the number of bytes has been reduced to the start threshold, the device will assert DTR indicating that it can receive input again. The device will also monitor the state of CTS and will stop transmission if the line becomes unasserted.

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Factory Preset
(no *RST): The factory default is On. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Serial Port RTS Setup

:SYSTem:COMMunicate:SERial[1]:CONTrol:RTS OFF|ON|IBFull

:SYSTem:COMMunicate:SERial[1]:CONTrol:RTS?

Sets the hardware pacing (hand-shaking) scheme. Many high speed asynchronous modems use this line (paired with CTS) as receive/transmit pacing. Only one Option 1AX can be installed in an instrument.

Off - indicates that the RTS line should always be asserted

On - indicates that the RTS line should always be unasserted

IBFull - selects the input buffer full mode for the RTS line. IBFull sets the RTS line to indicate when the device is ready to receive. When the number of received bytes in the input buffer of the device reaches the stop threshold, the device will unassert the RTS line. When the number of bytes has been reduced to the start threshold, the device will assert RTS indicating that it can receive input again. RTS is sometimes called RFR (ready for receiving). The device will also monitor the state of CTS and will stop transmission if that line becomes unasserted.

Factory Preset
(no *RST): The factory default is IBFull. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Serial Port Baud Rate Setup

:SYSTem:COMMunicate:SERial[1][:RECeive]:BAUD <baud_rate>

:SYSTem:COMMunicate:SERial[1][:RECeive]:BAUD?

Only one Option 1AX can be installed in an instrument.

Factory Preset
(no *RST): The factory default is 9600. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Range: Supported baud rates are
110|300|600|1200|2400|4800|9600|19200|38400|
57600|115200

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Front Panel Access: **System, Remote Port**

Serial Port Receive Pace Setup

`:SYSTem:COMMunicate:SERial[1][:RECeive]:PACE XON|NONE`

`:SYSTem:COMMunicate:SERial[1][:RECeive]:PACE?`

Set the receive pace to on or none for an instrument, with the RS-232 interface installed. Only one Option 1AX can be installed in an instrument. If no optional serial port number is specified, port 1 is assumed.

Factory Preset (no *RST): The factory default is none. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Serial Port Transmit Pace Setup

`:SYSTem:COMMunicate:SERial[1]:TRANsmit:PACE XON|NONE`

`:SYSTem:COMMunicate:SERial[1]:TRANsmit:PACE?`

Set the transmit pace to on or none for an instrument, with the RS-232 interface installed. Only one Option 1AX can be installed in an instrument. If no optional serial port number is specified, port 1 is assumed.

Factory Preset (no *RST): The factory default is none. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Hardware Configuration Query

`:SYSTem:CONFigure:HARDware?`

Returns string of information about the current hardware in the instrument.

Front Panel Access: **System, Show Hardware**

Display the Hardware Configuration

`:SYSTem:CONFigure:HARDware:STATe OFF|ON|0|1`

`:SYSTem:CONFigure:HARDware:STATe?`

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Shows the current hardware configuration of the instrument on the display.

Factory Preset and *RST: Off

Front Panel Access: **System, Show Hdwr**

Query License Key Information

:SYSTem:CONFigure:LKEY?

Returns a comma separated list of options with their respective license keys.

Factory Preset and *RST: Off

Example: `SYST:CONF:LKEY?`

The above query could return the string:
`"BAH,2488CE2109E9,1DS,7ED64A85E30F,1DR,C1DC3BF2B4FA"`

History: Added command with firmware revision A.14.00.

Front Panel Access: **System**, **Licensing**, **Show License**

Display License Key Information

:SYSTem:CONFigure:LKEY:STATe OFF|ON|0|1

:SYSTem:CONFigure:LKEY:STATe?

Turns on/off the display of the current license key information for instrument options.

Factory Preset and *RST: Off

History: Added command with firmware revision A.14.00.

Front Panel Access: **System**, **Licensing**, **Show License**

System Configuration Query

:SYSTem:CONFigure[:SYSTem]?

Returns string of information about the configurations of the instrument.

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Front Panel Access: **System, Show System**

Display System Configuration

`:SYSTem:CONFigure[:SYSTem]:STATe OFF|ON|0|1`

`:SYSTem:CONFigure[:SYSTem]:STATe?`

Shows the current system configuration of the instrument on the display.

Factory Preset and *RST: Off

Front Panel Access: **System, Show System**

Set Date

`:SYSTem:DATE <year>,<month>,<day>`

`:SYSTem:DATE?`

Sets the date of the real-time clock of the instrument.

Year is a 4-digit integer

Month is an integer 1 to 12

Day is an integer 1 to 31 (depending on the month)

Front Panel Access: **System, Time/Date, Set Date**

Error Information Query

`:SYSTem:ERRor[:NEXT]?`

This command queries the earliest entry to the error queue and then deletes that entry. *CLS clears the entire error queue.

Front Panel Access: **System, Show Errors**

Locate SCPI Command Errors

`:SYSTem:ERRor:VERBose OFF|ON|0|1`

`:SYSTem:ERRor:VERBose?`

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Adds additional information to the error messages returned by the **:SYSTem:ERRor?** command. It indicates which SCPI command was executing when the error occurred and what about that command was unacceptable.

<error number>,"<error message>;<annotated SCPI command>"

The maximum length of the <annotated SCPI command> is 80 characters. If the error occurs in a SCPI command longer than 80 characters, the <Err> sentinel is placed at the end of the <annotated SCPI command>.

Example: First set **SYST:ERR:VERBose ON**

If the command **SENSe:FREQuently:CENTer 942.6MHz** is sent, then sending **SYST:ERR?** returns:

```
–113,"Undefined header;SENSe:FREQuently:<Err>CENTer 942.6MHz $<NL>"
```

The <Err> shown after FREQuently shows you the spelling error. (The $<NL> is the typical representation for the command terminator.

If the command **SENSe:FREQ:CENTer 942.6Sec** is sent, then sending **SYST:ERR?** returns:

```
–131,"Invalid suffix;SENSe:FREQuency:CENTer 942.6Sec<Err> $<NL>"
```

The <Err> shown after Sec shows you the invalid suffix.

Factory Preset and *RST: Not affected by *RST

Remarks: The verbose SCPI error debugging state is global to all the SCPI interfaces.

History: Added with firmware revision A.08.00.

Front Panel Access: System, Show Errors, Verbose SCPI ON OFF

Host Identification Query

:SYSTem:HID?

This command returns a string that contains the host identification. This ID is required in order to obtain the license key that enables a new application or option.

Front Panel Access: **System, Show System**

License Key – Install Application/Option

:SYSTem:LKEY <"option">, <"license key">

:SYSTem:LKEY? <"option">

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This command enters the license key required for installing the specified new application or option. The query returns a string that contains the license key for a specified application or option that is already installed in the instrument. The license key will also be returned if the application is not currently in memory, but had been installed at some previous time.

Example: `:SYST:LKEY "BAC", "123A456B789C"`

An option is a three character string that specifies the option or application that is to be installed, as found in the Ordering Guide (for example, BAH for GSM Measurement Personality). The option name must be enclosed in quotes.

A license key is a 12-character hexadecimal string given with the option. The license key is unique to a specific option installed in the instrument with a specific host ID, as returned by `:SYST:HID?`. The license key must be enclosed in quotes.

Front Panel Access: **System, Licensing**

Delete a License Key

`:SYSTem:LKEY:DELete <"option">`

This command allows you to delete the license key from instrument memory for the selected option.

NOTE In general, deleting the license key number is not recommended. If the license key is deleted, you will be unable to reload or update the application in instrument memory without re-entering the license key. The license key works with one particular instrument host ID only.

Query Instrument Options

`:SYSTem:OPTions?`

Returns a list of the options that are installed.

It is a comma separated list such as: "1DS,1D6,A4H,A4J,1DN"

Front Panel Access: **System, Show System**

Power On Elapsed Time

`:SYSTem:PON:ETIMe?`

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Returns the number of seconds that have elapsed since the analyzer was turned on for the very first time.

Front Panel Access: **System, Show System**

Power On Time

:SYSTem:PON:TIME?

Returns the number of milliseconds that have elapsed since the analyzer was last turned on.

Power On Type

:SYSTem:PON:TYPE PRESet|LAST

:SYSTem:PON:TYPE?

Sets the defined instrument conditions after a power-on or **Preset**.

PRESet - The instrument settings at power-on will be either the factory preset or user preset, as set by **:SYSTem:PRESet:TYPE FACTory|USER.**

LAST - The instrument settings at power-on will be the settings at the time of power down.

Factory Preset and *RST: The factory default is Preset. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

Front Panel Access: **System, Power On/Preset, Power On Last Preset**

Enable IF/Video/Sweep Output Ports

:SYSTem:PORTs:IFVSweep:ENABle OFF|ON|0|1

:SYSTem:PORTs:IFVSweep:ENABle?

This command enables or disables the IF, video, and sweep output ports for analyzers having options A4J (IF, Sweep, and Video Ports) and AYX (Fast Time Domain Sweeps).

Factory Preset and *RST: On

Example: **:SYST:PORT:IFVS:ENAB ON**

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Range: On/Off

History: Added with firmware revision A.04.00.

Remarks: Disable the output ports for faster measurement times.

Preset

`:SYSTem:PRESet`

Returns the instrument to a set of defined conditions. The particular set is selected by **`:SYSTem:PRESet:TYPE`**. This command does not change any persistent parameters. The term persistent means that the command retains the setting previously selected, even through a power cycle.

Front Panel Access: **Preset**

Persistent State Reset

`:SYSTem:PRESet:PERSistent`

Sets the persistent state values to their factory defaults. The term persistent means that the command retains the setting previously selected, even through a power cycle. Examples of persistent functions are: GPIB address, power-on type, and preset type.

Front Panel Access: **System, Restore Sys Defaults**

Preset Type

`:SYSTem:PRESet:TYPE FACTory|USER|MODE`

Selects the preset state to be either factory-defined or user-defined preset conditions.

Factory Preset and *RST: The factory default is **`MODE`**. This parameter is persistent, which means that it retains the setting previously selected, even through a power cycle.

History: Changed with firmware revision A.08.00. Previous firmware revisions had default type **`FACTory`**.

Remarks: **`:SYSTem:PRESet:USER:SAVE`** defines the *user preset*.

Front Panel Access: **System, Power On/Preset, Preset Type**

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Save User Preset

:SYSTem:PRESet[:USER]:SAVE

Saves the current instrument conditions as the *user preset* condition.

Front Panel Access: **System, Power On/Preset, Save Type Preset**

Speaker Control

:SYSTem:SPEaker[:STATe] OFF|ON|0|1

:SYSTem:SPEaker[:STATe]?

Turns the internal speaker on or off.

Factory Preset and *RST: Off

Front Panel Access: **Det/Demod, Demod, Speaker On Off**

Set Time

:SYSTem:TIME <hour>,<minute>,<second>

:SYSTem:TIME?

Sets the time of the real-time clock of the instrument.

Hour must be an integer 0 to 23.

Minute must be an integer 0 to 59.

Second must be an integer 0 to 59.

Front Panel Access: **System, Time/Date, Set Time**

SCPI Version Query

:SYSTem:VERSion?

Returns the SCPI version number with which the instrument complies.

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TRACe Subsystem

The TRACe subsystem controls access to the internal trace memory of the analyzer.

NOTE Refer also to :**CALCulate** and :**MMEMory** subsystems for more trace and limit line commands.

Copy Trace

:TRACe:COPY <source_trace>,<dest_trace>

Transfers the source trace to the destination trace and leaves the destination trace in VIEW mode.

Source traces are: TRACE1|2|3

Destination traces are: TRACE1|2|3

Example: **:TRAC:COPY TRACE2,TRACE1**

Front Panel Access: **View/Trace, Operations, 1 –> 3**

View/Trace, Operations, 2 –> 3

Transfer Trace Data

:TRACe[:DATA] <trace_name>|RAWTRACE,<definite_length_block>|<comma_separated_ASCII_data>

:TRACe[:DATA]? <trace_name> |RAWTRACE|LLINE1|LLINE2

This command transfers trace data from the controller to the instrument. The data format is set by the command :**FORMat [:TRACe][:DATA]**. If you've selected the ASCII data format, the data returned is comma-separated ASCII values. For REAL, INTeger, and UINTeger data formats, a definite length block of data is returned.

The query returns the current values of the designated trace. The data is terminated with <NL><END> (for GPIB that is newline, or linefeed, followed by EOI set true; for RS-232 this is newline only.)

LLINE1 and **LLINE2** can only be queried; they cannot be set.

<trace_name> is **TRACE1**|**2**|**3**

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NOTE

This command does not allow setting all trace points to the same amplitude value by sending just a single value. If you need to set all trace points to the same value, you must send the same value to each trace point.

Rawtrace data is available with **`UINT,16`** or **`INT,32`** formatting. It is unitless, returns uncorrected ADC values, and is the fastest method of obtaining measurement data.

Example: Suppose you are using a data format other then ASCII.

```
:TRAC:DATA TRACE1,#41604<binary trace
data><LF-EOI>
```

This sends the block of data values to trace 1. The block starts with the header: #41604.

- The first digit in the header tells you there are 4 more digits in the header.
- The 1604 means 1 thousand, 6 hundred, and 4 data bytes follow the header.
- Divide this number of bytes by your current data format (4 for real,32). Then there are 401 trace points in the block.
- The line feed EOI is sent as the terminator when using GPIB.

Remarks: Commands **`:MMEM:STOR:TRAC`** and **`:MMEM:LOAD:TRAC`** are used to transfer trace data to, or from, the internal hard drive or floppy drive of the instrument.

The number of points in a trace is specified by **`[:SENSe]:SWEep:POINts`**. The trace data format is determined by **`:FORMat[:TRACe][:DATA]`**, and the binary data byte order is determined by **`:FORMat:BORDer`**.

If the parameter to the query is **`LLINE1`** or **`LLINE2`**, a very large positive or negative value is returned at any point outside the range of limit values. A large positive number is returned for an upper limit, and a large negative value for lower limits. There is no SCPI short form for parameters **`LLINE1`**|**`LLINE2.`**

Exchange Traces

`:TRACe:EXCHange <trace_1>,<trace_2>`

Exchanges 2 traces, point by point and leaves both in VIEW mode.

Trace_1 choices are: TRACE1|2|3

Trace_2 choices are: TRACE1|2|3

Example: **`:TRAC:EXCH TRACE3,TRACE2`**

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Front Panel Access: **View/Trace, Operations, 1 <–> 3**

View/Trace, Operations, 2 <–> 3

Trace Math Add

`:TRACe:MATH:ADD <destination_trace>,<source_trace1>,<source_trace2>`

Adds the magnitudes of the two source traces and places the result in the destination trace.

Destination traces are: TRACE1|2|3

Source traces are: TRACE1|2|3

Example: **`:TRAC:MATH:ADD TRACE2,TRACE1,TRACE3`** is equivalent to : (trace 2 = trace 1 + trace 3)

Mean Trace Data

`:TRACe:MATH:MEAN? <trace>`

Returns the mean of the amplitudes of the trace amplitude elements in measurement units.

Traces are: TRACE1|2|3

Query the Signal Peaks

`:TRACe:MATH:PEAK[:DATA]?`

Outputs the signal peaks by frequency or by amplitude. This command uses only trace1 data. The data is returned as alternating amplitude, frequency pairs.

The sort mode is determined by the command :TRACe:MATH:PEAK:SORT. The commands :CALCulate:MARKer:PEAK:EXCursion and :CALCulate:MARKer:PEAK:THReshold are used to determine what is a signal peak. To get the number of signals found meeting the specified limits, use the query :TRACe:MATH:PEAK:POINts?

Query Number of Peaks Found

`:TRACe:MATH:PEAK:POINts?`

Outputs the number of signal peaks identified. The amplitude of the peaks can then

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be queried with :**TRACe:MATH:PEAK:DATA?** This command uses only trace1 data.

Peak Sorting

:TRACe:MATH:PEAK:SORT AMPLitude|FREQuency

:TRACe:MATH:PEAK:SORT?

Determines if the signals in the :**TRACe:MATH:PEAK:DATA?** query are sorted by frequency or amplitude.

Amplitude sorts the identified peaks by descending amplitude.

Frequency sorts the identified peaks by increasing frequency.

Smooth Trace Data

:TRACe:MATH:SMOoth <trace>

Smooths the trace according to the number of points specified in :**TRACe:MATH:SMOoth:POINts**. There is no equivalent front panel function.

Traces are: TRACE1|2|3, and RAWTRACE commands.

The purpose of this function is to perform a spatial video averaging as compared to the temporal version supplied by the video-average command **[:SENSe]:AVERage:TYPE VIDeo**. The functions of **:TRACe:MATH:SMOoth <trace>** and **[:SENSe]:AVERage:TYPE VIDeo|POWer** are not interchangeable.

Each point value is replaced with the average of the values of the selected number of points, with half of those points located on each side of any particular point (when possible). Refer to Figure 5-2. This figure illustrates a 401 point trace with a smoothing number of 31. Think of the trace points as “buckets” of data. To smooth (arbitrary) point 273, the analyzer averages buckets 258 through 287 and applies that value to point 273.

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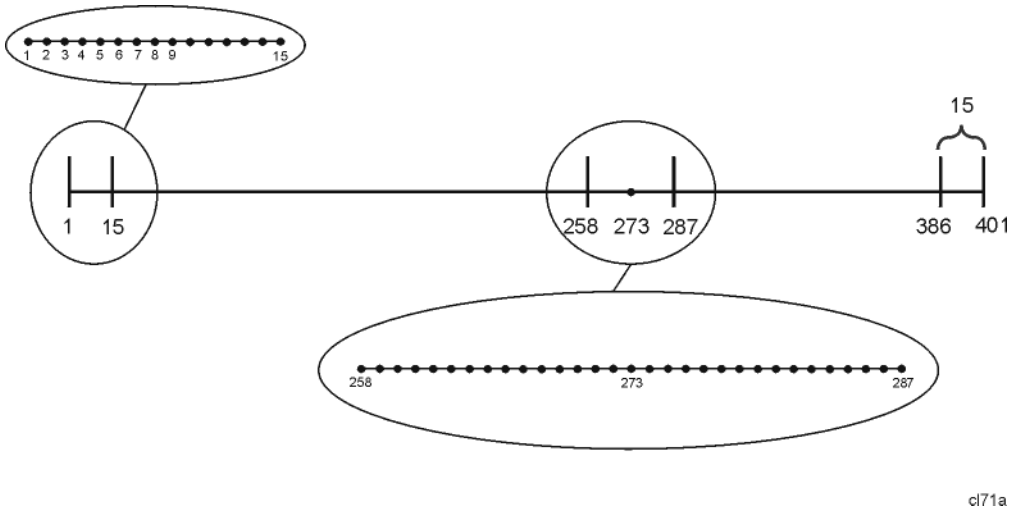
Figure 5-2 Smoothing With 401 Trace Points and 31 Smoothing Points



Increasing the number of points increases smoothing at the cost of decreasing resolution.

The amount of smoothing decreases at the end points. Because **`:TRACe:MATH:SMOoth <trace>`** averages values that occur before and after the data point in time, display irregularities can be caused at the start and stop frequencies. To avoid possible irregularities (signal distortion) at the ends of the trace, use small values for the smooth parameter.

Refer to Figure 5-2 for a discussion of this end-point smoothing phenomena. With 31 smoothing points and a 401 point trace, point 16 will be the first point to have full 31-bucket smoothing. Likewise, point 385 will be the last point with full 31-bucket smoothing. Under the conditions stated, points 2 through 15 will be smoothed as follows: Point 2 is derived from averaging buckets 1 through 3. Point 3 is derived from averaging buckets 1 through 5, Point 4 is derived from averaging buckets 1 through 7, and so forth until point 16 is reached. The quantity of buckets used for the smoothing running average increases at the rate of 2 buckets per point, from point 1 to point ([smoothing number/2] + 1), at which time the full number of smoothing points is utilized. The same characteristic occurs at the completion of the trace, beginning at point 386, when the number of averaging buckets begins to decrease until point 401 is reached.

By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time; as such, frequency resolution is decreased. Also, signal peaks are reduced with large smoothing

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values; and this can cause the amplitude to appear to be less than its actual value.

Number of Points for Smoothing

:TRACe:MATH:SMOoth:POINts <integer>

:TRACe:MATH:SMOoth:POINts?

Specifies the number of points that will be smoothed in **:TRACe:MATH:SMOoth**. See that command for an explanation of how smoothing is performed.

Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the number of sweep points, then the number of sweep points is used, unless the number of sweep points is even, in which case the number of points will be the sweep points minus one. The number of points smoothed is always an odd number.

Range: Integer, 3 to current number of sweep points

Trace Math Subtract

:TRACe:MATH:SUBTract
<destination_trace>,<source_trace1>,<source_trace2>

Subtracts the magnitude of the two source traces (trace 1 – trace 2) and places the result in the destination trace.

Destination traces are: TRACE1|2|3

Source traces are: TRACE1|2|3

Example: **:TRAC:MATH:SUBT TRACE3,TRACE3,TRACE2** is equivalent to: (trace 3 = trace 3 – trace 2)

Trace Math Subtract From Display Line

:TRACe:MATH:SUBTract:DLINe <trace>

Subtracts the magnitude of the display line from the selected trace and places the result back in the selected trace.

Trace is: TRACE1|2|3

Example: **:TRAC:MATH:SUBT:DLIN TRACE1**

is equivalent to: (trace1 = trace 1 – display line)

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Front Panel Access: **View/Trace, Operations, 2 – DL –> 2**

Select Trace Display Mode

:TRACe1|2|3:MODE WRITe|MAXHold|MINHold|VIEW|BLANk

:TRACe1|2|3:MODE?

Selects the display mode for the selected trace.

Write puts the trace in the normal mode, updating the data.

Maximum hold displays the highest measured trace value for all the data that has been measured since the function was turned on.

Minimum hold displays the lowest measured trace value for all the data that has been measured since the function was turned on.

View turns on the trace data so that it can be viewed on the display.

Blank turns off the trace data so that it is not viewed on the display.

Remarks:. Whenever the number of sweep points change, the following functions are affected:

- All trace data is erased
- Any traces in view mode will go to blank mode

Front Panel Access:. **View/Trace, Clear Write**

View/Trace, Max Hold

View/Trace, Min Hold

View/Trace, View

View/Trace, Blank

View/Trace, Normalize, Ref Trace View Blank

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TRIGger Subsystem

The TRIGger subsystem is used to set the controls and parameters associated with triggering the data acquisitions. Other trigger-related commands are found in the INITiate and ABORt subsystems.

External Trigger, Line, and TV Trigger Delay Value

:TRIGger[:SEQuence]:DELay <delay>

:TRIGger[:SEQuence]:DELay?

This command sets the amount of trigger delay when using the rear panel external trigger input, the front panel input with TV trigger, or the line trigger.

Factory Preset and *RST: 1 µs

Range: 0.3 µs to 429 seconds

Default Unit: seconds

External Trigger, Line, and TV Trigger Delay Enable

:TRIGger[:SEQuence]:DELay:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:DELay:STATe?

This command allows you to turn on or off a delay, during which the analyzer will wait to begin a sweep after receiving an external trigger signal, a front panel TV trigger, or a line trigger.

Factory Preset and *RST: Off

Default Unit: seconds

Remarks: Free-run activates the trigger condition that allows the next sweep to start as soon as possible after the last sweep. This function is not available when **Gate** is on.

Front Panel Access: **Trig, Trig Delay On Off**

External Trigger Slope

:TRIGger[:SEQuence]:EXTernal[1]:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:EXTernal[1]:SLOPe?

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This command activates the trigger condition that allows the next sweep to start when the external voltage (connected to **GATE TRIG/EXT TRIG IN** on the rear panel) passes through approximately 1.5 volts. The external trigger signal must be a 0 V to +5 V TTL signal. This function only controls the trigger polarity (for positive or negative-going signals).

Factory Preset and *RST: Positive

Front Panel Access: **Trig, External Pos Neg**

Trigger Offset

`:TRIGger[:SEQuence]:OFFSet <time>`

`:TRIGger[:SEQuence]:OFFSet?`

This command sets the trigger offset.

Factory Preset and *RST: 0 seconds

Example: **`:TRIG:SEQ:OFFS 1.0s`**

Range: Hardware specific; dependent upon the ADC being used, current state, and the number of sweep points.

Default Unit: seconds

Remarks: Trigger offset refers to the specified time interval before or after the trigger event from which data is to be written to the trace, and then displayed. Ordinarily, the trigger offset value is zero, and trace data is displayed beginning at the trigger event. A negative trigger offset value results in the display of trace data prior to the trigger event. A positive trigger offset value results in an effective delay in the display of trace data after the trigger event.

The trigger offset value used when the feature is enable will depend on the following parameters:

- Normal trigger offset value originally entered
- Specific instrument hardware in use
- Sweep time
- Number of sweep points

The effective trigger offset value will be re-calculated whenever any of these parameters change.

Front Panel Access: **Trig, Trig Offset**

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Trigger Offset

:TRIGger[:SEQuence]:OFFSet:STATe OFF|ON|0|1

:TRIGger[:SEQuence]:OFFSet:STATe?

Turns the trigger offset on and off.

Factory Preset and *RST: Off

Example: **:TRIG:OFFS:STAT ON**

Front Panel Access: **Trig, Trig Offset**

RF Burst Frequency Selectivity

:TRIGger[:SEQuence]:RFBurst:FSELectivity[:STATe] OFF|ON|0|1

:TRIGger[:SEQuence]:RFBurst:FSELectivity?

The RF burst circuit can sample the 21.4 MHz IF either before or after RBW filtering. When frequency selectivity is On, the RBW-filtered IF signal is used, increasing the frequency selectivity.

This command is available only when Option B7E (RF Communications Hardware) is installed.

Factory Preset and *RST: Off

History: Added with firmware revision A.08.00.

Front Panel Access: **Trig, More 1 of 2, RF Burst Setup, Frequency Selectivity**

RF Burst Absolute Mode Setting

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute <ampl>

:TRIGger[:SEQuence]:RFBurst:LEVel:ABSolute?

Select the trigger level of the RF burst envelope signal. The value can be set to an absolute level, with the units displayed in the current y-axis units.

This command is available only when Option B7E (RF Communications Hardware) is installed.

Factory Preset and *RST: 0 dBm

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Range: –100 dBm to 100 dBm

Default Unit: dBm

History: Added with firmware revision A.08.00.

Front Panel Access: **Trig, More 1 of 2, RF Burst Setup**

RF Burst Relative Mode Setting

`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative <rel_ampl>`

`:TRIGger[:SEQuence]:RFBurst:LEVel:RELative?`

Set the trigger level when using the RF burst (wideband) trigger. The value is relative to the peak of the burst. RF burst is also known as RF envelope.

This command is available only when Option B7E (RF Communications Hardware) is installed.

Factory Preset and *RST: –6 dB

Range: –45 dB to 0 dB

Default Unit: dB

History: Added with firmware revision A.08.00.

Front Panel Access: **Trig, More 1 of 2, RF Burst Setup**

RF Burst Mode Setting

`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE ABSolute|RELative`

`:TRIGger[:SEQuence]:RFBurst:LEVel:TYPE?`

Select the trigger level of the RF burst envelope signal. The level can be set to either a level relative to the peak of the burst (RELative mode) or to an absolute level (ABSolute mode).

This command is available only when Option B7E (RF Communications Hardware) is installed.

Factory Preset and *RST: Relative

History: Added with firmware revision A.08.00.

Front Panel Access: **Trig, More 1 of 2, RF Burst Setup**

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RF Burst Narrow Pulse Discriminator

:TRIGger[:SEQuence]:RFBurst:NPDiscrim[:STATe] OFF|ON|0|1

:TRIGger[:SEQuence]:RFBurst:NPDiscrim?

The narrow pulse discriminator prevents undesirable re-triggering on multiple peaks when the RF envelope has significant ripple.

Factory Preset and *RST: Off

History: Added with firmware revision A.08.00.

Front Panel Access: **Trig, More 1 of 2, RF Burst Setup, Narrow Pulse Discriminator**

Trigger Source

:TRIGger[:SEQuence]:SOURce IMMediate|VIDeo|LINE|EXTernal|RFBurst|TV

:TRIGger[:SEQuence]:SOURce?

Specifies the source (or type) of triggering used to start a measurement.

Immediate is free-run triggering

Video triggers on the video signal level

Line triggers on the power line signal

External allows you to connect an external trigger source

RF Burst triggers on the bursted frame

TV triggers on the selected line of a TV frame

Factory Preset and *RST: Immediate (free-run triggering)

Remarks: Free-run activates the trigger condition that allows the next sweep to start as soon as possible after the last sweep.

History: Added TV trigger mode with firmware revision A.03.00.

Added RF Burst mode for analyzers having Option B7E (RF Communications Hardware), with firmware revision A.08.00.

Front Panel Access: **Trig, Free Run**

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Trig, Video

Trig, Line

Trig, External Pos Neg

Trig, TV

Trig, RF Burst

NOTE Trigger Delay is not available in Free Run, so turning Free Run on turns off Trigger Delay, but preserves the value of Trigger Delay.

Set TV Field Mode

`:TRIGger[:SEQuence]:TV:FMODe ENTire|ODD|EVEN`

`:TRIGger[:SEQuence]:TV:FMODe?`

This command allows the user to determine how the fields of the TV picture signal will be treated by the trigger system. Requires Option BAA and B7B.

Factory Preset and *RST: ENTire (entire frame)

Range:

ENTire (entire frame)

For formats NTSC-M, NTSC-Japan, and PAL-M, the minimum line is 1, and the maximum line is 525.

For formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L, the minimum line is 1, and the maximum line is 625.

ODD (Field 1)

For formats NTSC-M, NTSC-Japan, and PAL-M, the minimum line is 1, and the maximum line is 263.

For formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L, the minimum line is 1, and the maximum line is 313.

EVEN (Field 2)

For formats NTSC-M, NTSC-Japan, and PAL-M, the minimum line is 1, and the maximum line is 262.

For formats PAL-B, D, G, H, I, PAL-N, PAL-N Combin, and SECAM-L, the minimum line is 1, and the maximum line is 312.

NOTE Refer to "TV" on page 167 for a more detailed explanation of TV fields and command dependencies.

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History: Added TV trigger mode with firmware revision A.03.00.

Front Panel Access: **Trig, TV Trig Setup, Field, Entire Frame**

Trig, TV Trig Setup, Field, Field One

Trig, TV Trig Setup, Field, Field Two

Set TV Line Number for Synchronization

:TRIGger[:SEQuence]:TV:LINE <line>

:TRIGger[:SEQuence]:TV:LINE?

This command allows you to set the TV line number to which the analyzer will synchronize its sweep. Requires Option BAA and B7B.

Factory Preset and *RST: 17

Range: The range is dependent upon the Field Mode, as described in the command :**TRIGger[:SEQuence]:TV:FMODe ENTire|ODD|EVEN** : The minimum value is the minimum line, and rolls over to the maximum value. The maximum value is the maximum line, and rolls over to the minimum value.

History: Added TV trigger mode with firmware revision A.03.00.

Remarks: Refer to the command :TRIGger[:SEQuence]:SOURce:TV, which is used to activate TV triggering.

Set Analyzer for TV Picture Monitoring

:TRIGger[:SEQuence]:TV:MONitor OFF|ON|0|1

:TRIGger[:SEQuence]:TV:MONitor?

The currently-selected standard is used to determine the proper setup of the hardware state of the video digitization circuitry for presentation of the TV picture. Requires Option BAA and B7B.

Factory Preset and *RST: Off

History: Added TV trigger mode with firmware revision A.03.00.

Front Panel Access: **Trig, TV Trig Setup, TV Monitor**

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Set the Video Waveform Sync. Pulse Direction

:TRIGger[:SEQuence]:TV:SLOPe POSitive|NEGative

:TRIGger[:SEQuence]:TV:SLOPe?

This command defines the direction of the sync pulse on the TV video waveform.

Normal baseband video has sync pulses on the bottom of the waveform (use the **NEG** parameter for more negative voltage). However, when the analyzer is used to demodulate an NTSC or PAL TV RF carrier, the detected video waveform is "upside down" with sync pulses on the top of the waveform (use the **POS** parameter for more positive voltage). When the analyzer is used to demodulate a SECAM TV RF carrier, the detected video waveform has normal polarity (use the **NEG** parameter).

Factory Preset and *RST:	POSitive
History:	Added TV trigger mode with firmware revision A.03.00.
Front Panel Access:	**Trig, TV Trig Setup, Sync Pos Neg**

Select TV Signal Path

:TRIGger[:SEQuence]:TV:SOURce SANalyzer|EXTernal

:TRIGger[:SEQuence]:TV:SOURce?

This command is used to select between the internal spectrum analyzer signal path (the detected video is fed to the TV trigger), or the **EXT VIDEO IN** connector on the analyzer rear panel. Requires Option BAA and B7B.

Factory Preset and *RST:	SANalyzer
History:	Added TV trigger mode with firmware revision A.03.00.
Front Panel Access:	**Trig, TV Trig Setup, TV Source, SA** **Trig, TV Trig Setup, TV Source, EXT Video In**

Select TV Standard

:TRIGger[:SEQuence]:TV:STANdard
MNTSc|JNTSc|MPAL|BPAL|NPAL|CPAL|LSEC

:TRIGger[:SEQuence]:TV:STANdard?

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This command allows you to choose one of the various TV standards. Requires Option BAA and B7B.

As the TV standard is changed, the current line value is clipped as necessary to keep it valid for the chosen standard and field mode. For example, line 600 is selected in Entire Frame mode in PAL-N; if NTSC-M is selected, the line number is clipped to 525. Or, if line 313 is selected in Field 1 mode in PAL-N and NTSC-M is selected, the line number is clipped to 263. Changing back to the PAL-N standard will leave the line number at 263.

Factory Preset and *RST: NTSC-M

Example: `:TRIG:SEQ:TV:STAN MNTS`

History: Added TV trigger mode with firmware revision A.03.00.

Remarks: Once this function is defined, the selected type is persistent. Persistent means that it retains the setting previously selected, even through a power cycle. The setting will change with “Load State.”

Front Panel Access: Trig, TV Trig Setup, Standard, NTSC-M

Trig, TV Trig Setup, Standard, NTSC-Japan

Trig, TV Trig Setup, Standard, PAL-M

Trig, TV Trig Setup, Standard, PAL-B,D,G,H,I

Trig, TV Trig Setup, Standard, PAL-N

Trig, TV Trig Setup, Standard, PAL-N Combin

Trig, TV Trig Setup, Standard, SECAM-L

Video Trigger Level Amplitude

`:TRIGger[:SEQuence]:VIDeo:LEVel <ampl>`

`:TRIGger[:SEQuence]:VIDeo:LEVel?`

Specifies the level at which a video trigger will occur.

Factory Preset and *RST: 2.5 divisions below reference level

Range: 10 display divisions below reference level to reference level

Default Unit: current amplitude units

Remarks: Video is adjusted using this command, but must also be selected using the command **`:TRIGger[:SEQuence]:SOURce VIDeo`**. When in FM Demod and Demod View is on, the Video Trigger level is adjusted/queried using the command

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:TRIGger[:SEQuence]:VIDeo:LEVel:FREQuency <freq>.

NOTE Trigger Delay is not available in Video trigger mode, so turning Video on turns off Trigger Delay, but preserves the value of Trigger Delay.

Front Panel Access: **Trig, Video**

Video Trigger Level Frequency

:TRIGger[:SEQuence]:VIDeo:LEVel:FREQuency <freq>

:TRIGger[:SEQuence]:VIDeo:LEVel:FREQuency?

This command is used to adjust the Video Trigger level when in FM Demod, and Demod View is on.

Default Unit: Hz

Remarks: Video is adjusted using this command, but must also be selected using the command **:TRIGger[:SEQuence]:SOURce VIDeo**. When not in FM Demod, the Video Trigger level is adjusted/queried using the command **:TRIGger[:SEQuence]:VIDeo:LEVel <ampl>**.

NOTE Trigger Delay is not available in Video trigger mode, so turning Video on turns off Trigger Delay, but preserves the value of Trigger Delay.

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UNIT Subsystem

Select Power Units of Measure

:UNIT:POWer DBM|DBMV|DBUV|DBUA|V|W|A

:UNIT:POWer?

Specifies amplitude units for the input, output and display.

Factory Preset and *RST: dBm in log amplitude scale

volts in linear amplitude scale

History: Ampere and decibel microampere units are available only with instruments having firmware revision A.06.00 and later.

Front Panel Access: **AMPLITUDE/Y Scale, Amptd Units**

AMPLITUDE/Y Scale, Amptd Units, dBm

AMPLITUDE/Y Scale, Amptd Units, dBmV

AMPLITUDE/Y Scale, Amptd Units, dBμV

AMPLITUDE/Y Scale, Amptd Units, Volts

AMPLITUDE/Y Scale, Amptd Units, Watts

AMPLITUDE/Y Scale, Amptd Units, Amps

AMPLITUDE/Y Scale, Amptd Units, dBμA

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6 Menu Maps

This chapter provides a visual representation of the front panel keys and their associated menu keys (in **Spectrum Analysis** mode). Refer to Chapter 2 , “Front-Panel Key Reference,” on page 37 for key function descriptions. See Volume 2 for the menu maps of the one-button power measurements (**MEASURE** key) and their associated setup keys.

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What You Will Find in This Chapter

This chapter provides menu maps for all front-panel keys except those associated with the measurements available when you press the front-panel **MEASURE** key. (Refer to Volume 2 for the one-button power measurement key menus.)

The Alpha Editor Menu is shown separately, though it is accessed when entering data for many keys. The front-panel key menus appear in alphabetical order as follows:

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Det/Demod	Page 396
Display	Page 397
File	Page 398, Page 399, Page 400
Freq Count	Page 401
FREQUENCY Channel	Page 402
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Sweep	Page 411
System	Page 412
Trace/View	Page 413
Trig	Page 414

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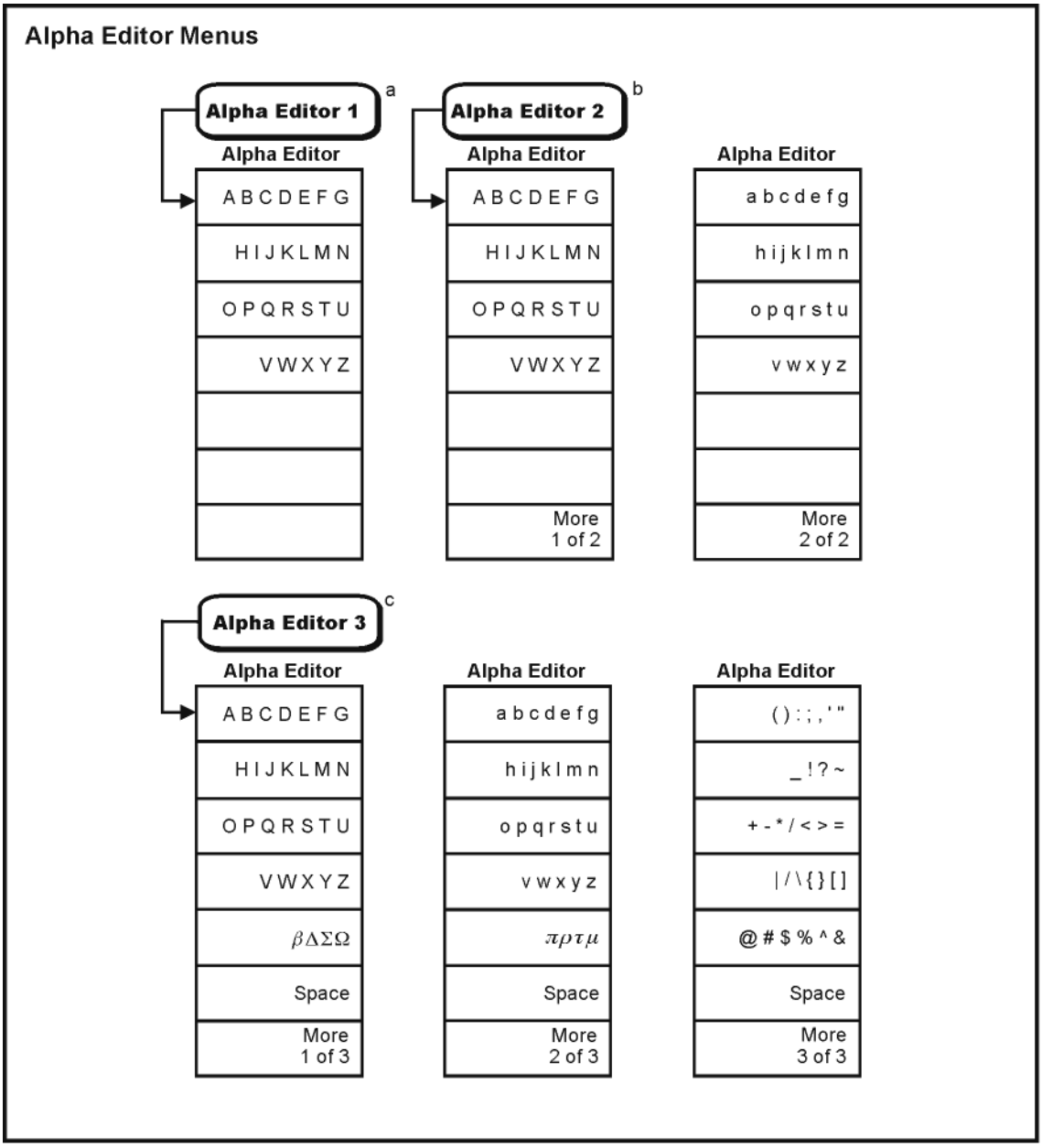
Alpha Editor Menu


Alpha Editor Menus
Alpha Editor 1
a
Alpha Editor
A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z
Alpha Editor 2
b
Alpha Editor
A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z
More
1 of 2
Alpha Editor
a b c d e f g
h i j k l m n
o p q r s t u
v w x y z
More
2 of 2
Alpha Editor 3
c
Alpha Editor
A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z
βΔΣΩ
Space
More
1 of 3
Alpha Editor
a b c d e f g
h i j k l m n
o p q r s t u
v w x y z
πρτμ
Space
More
2 of 3
Alpha Editor
( ) : ; , ' "
_ ! ? ~
+ - * / < > =
| / \ { } [ ]
@ # $ % ^ &
Space
More
3 of 3

a. The Alpha Editor 1 menu is used to configure system options and licensing.
b. The Alpha Editor 2 menu is used to name files.
c. The Alpha Editor 3 menu is used to change titles on the display.

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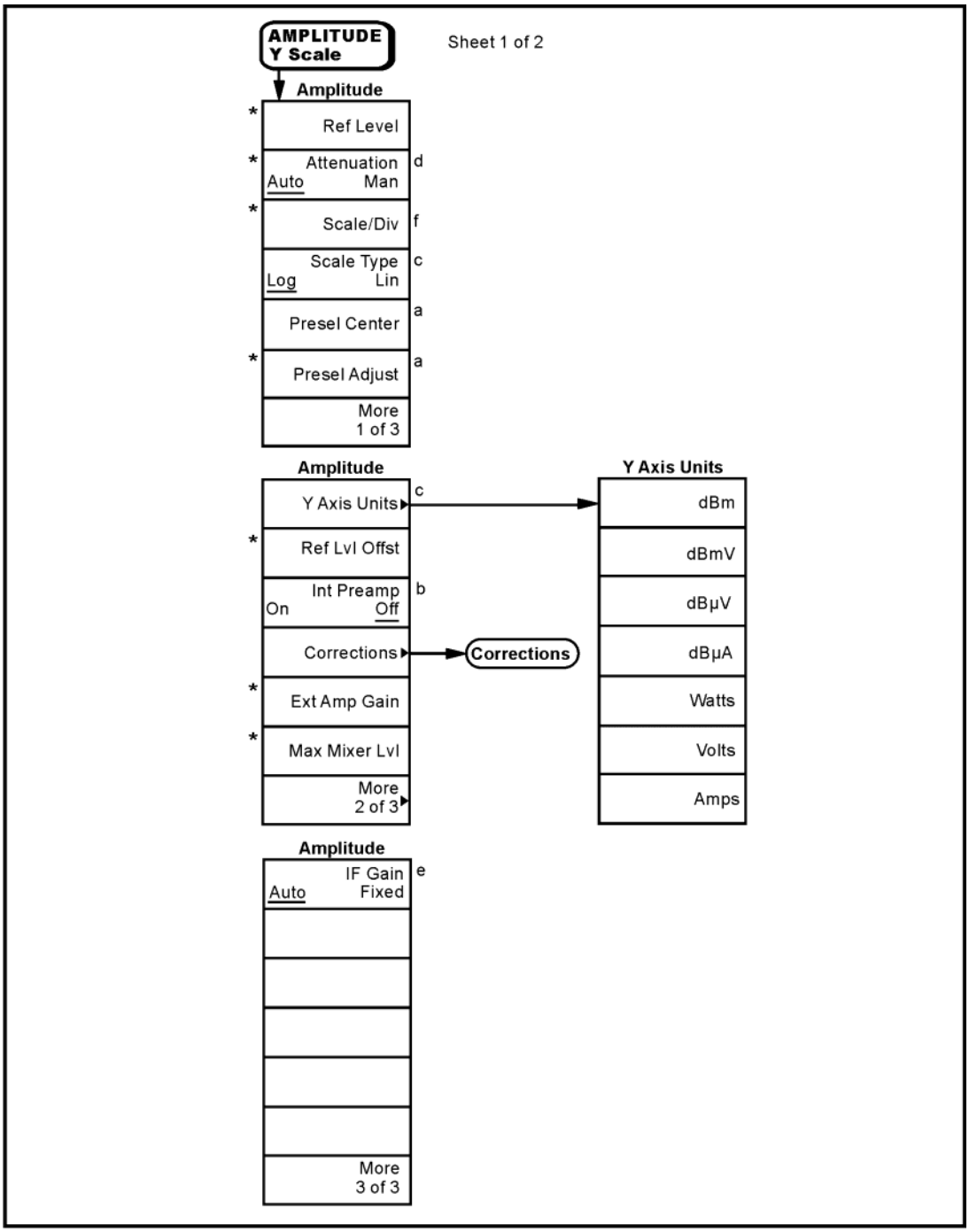
AMPLITUDE Y Scale Menu



a. Agilent E4404B, E4405B, E4407B and E4408B only
b. ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
c. Grayed out in FM Demod. **Demod View (On)**
d. Not available in External Mixing Mode (Option AYZ)
e. Available only with Option 1DR (Narrow Resolution Bandwidth) and firmware revision ≥ A.06.00
f. Grayed out when Demod View is accessed through Option 106 (Bluetooth FM Demodulation)
* An active function which allows data entry

pl749b

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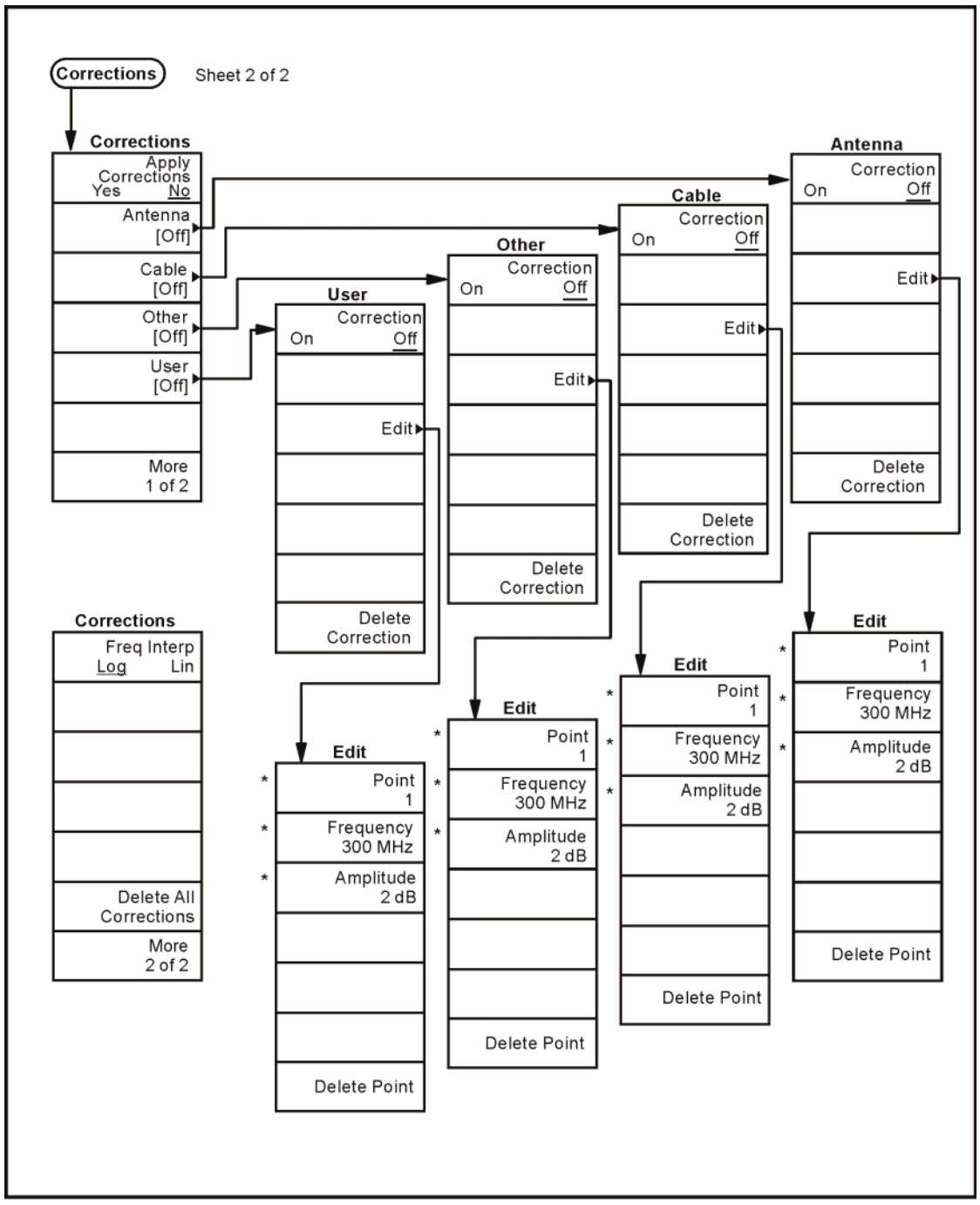
Amplitude Y Scale: Corrections Menu



* An active function which allows data entry

pl750b

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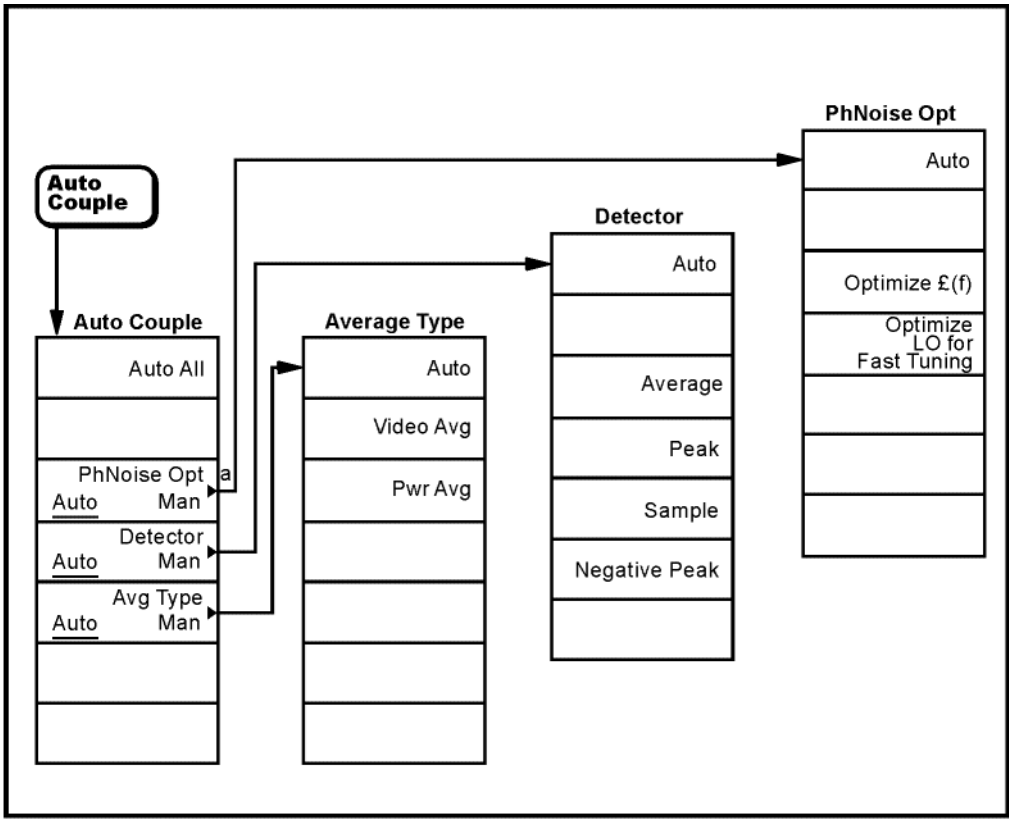
Auto Couple Menu



a. Not available on models E4401B and E4411B.

pl753b

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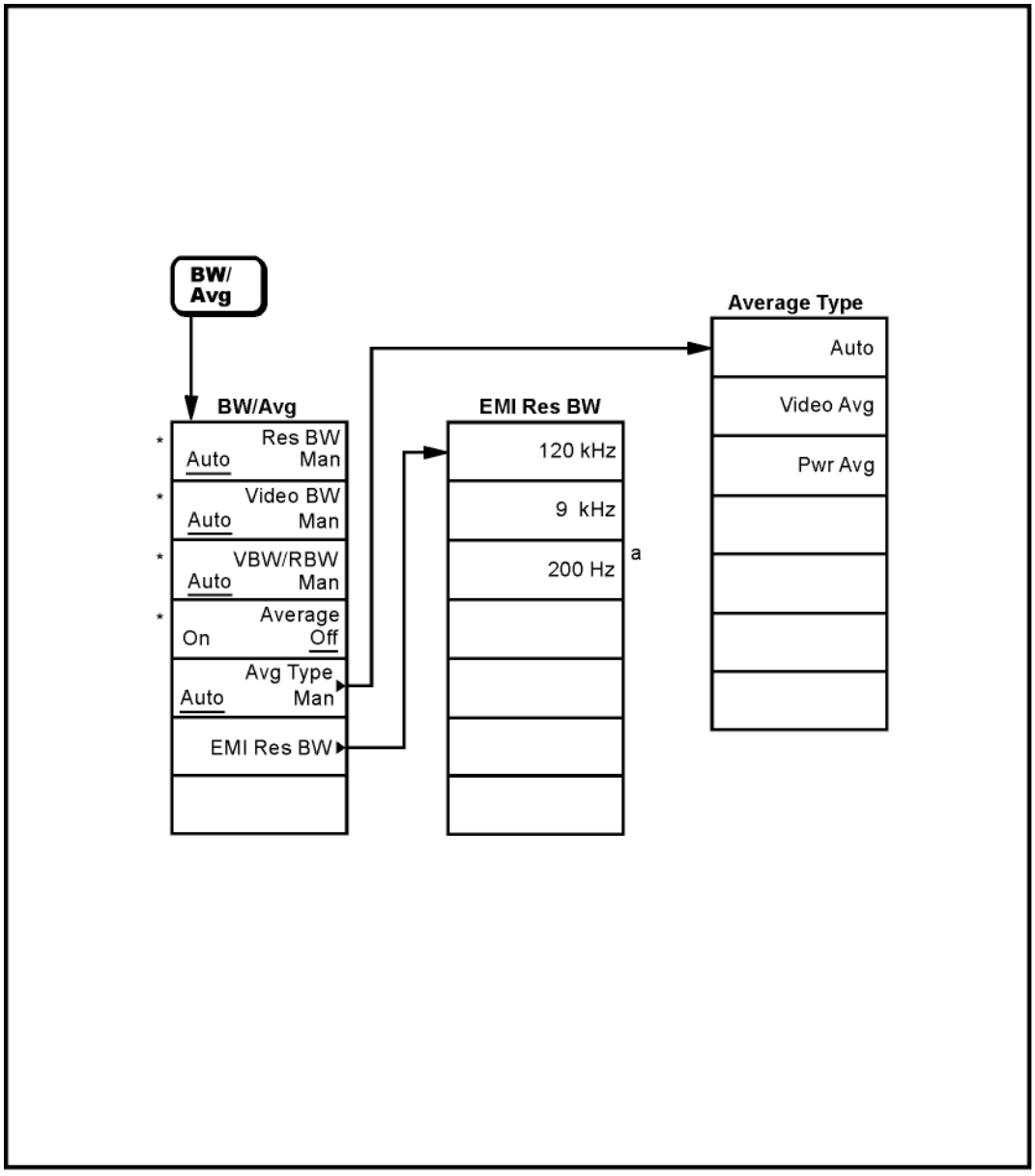
BW/Avg Menu



a. Available only with Option 1DR (narrow resolution bandwidth) and spans < 5MHz
* An active function which allows data entry

pl754b

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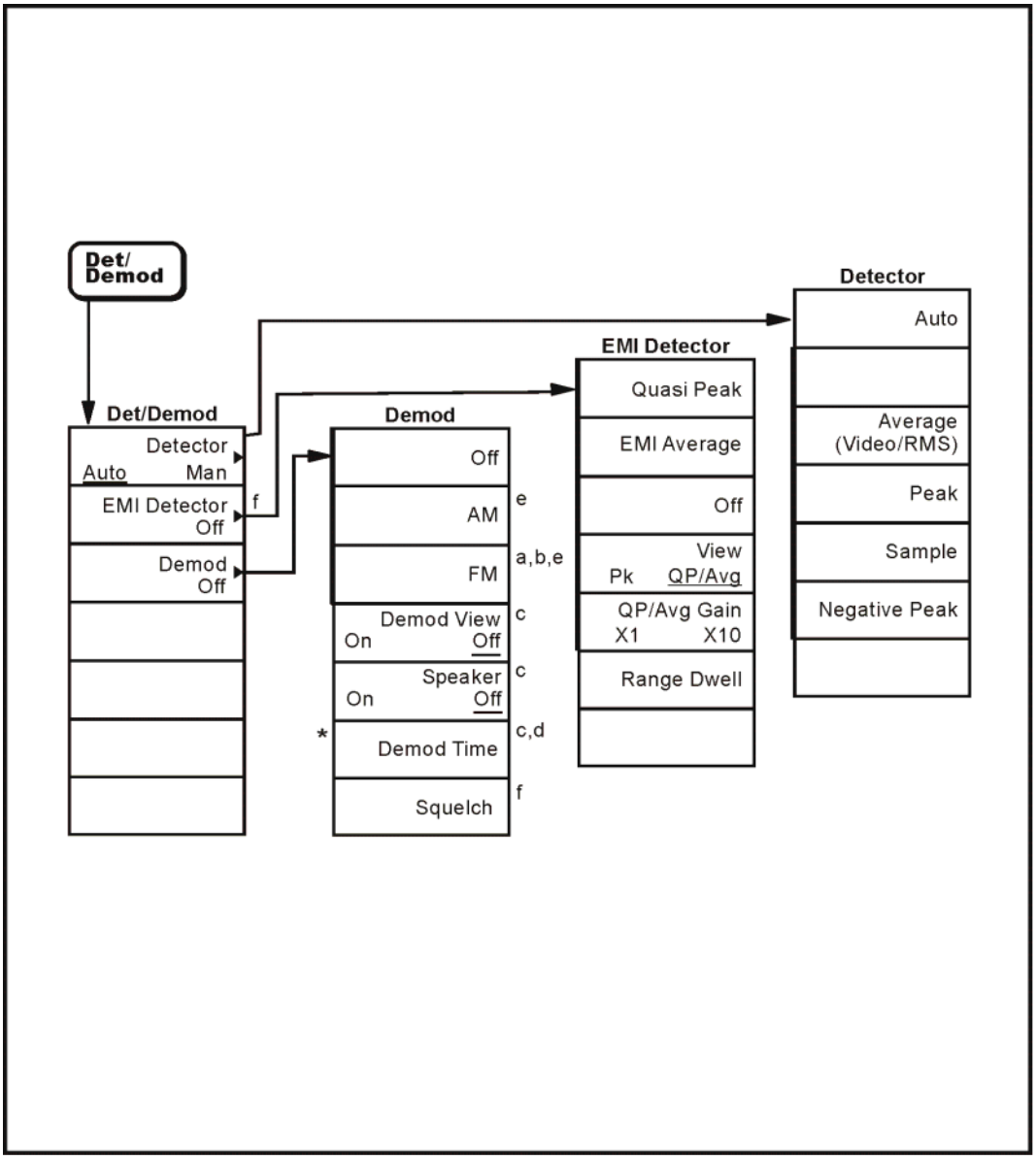
Det/Demod Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
b. Available only with Option AYQ (FM Demod/Quasi-peak) BAA (FM Demod) or Option 106 (Bluetooth FM Demodulation)
c. Grayed out unless **AM** or **FM Demod** is on
d. Grayed out when span = 0 Hz
e. Turns the speaker on
f. Available only with Option AYQ (FM Demod/Quasi-peak)
* An active function which allows data entry

pl756b

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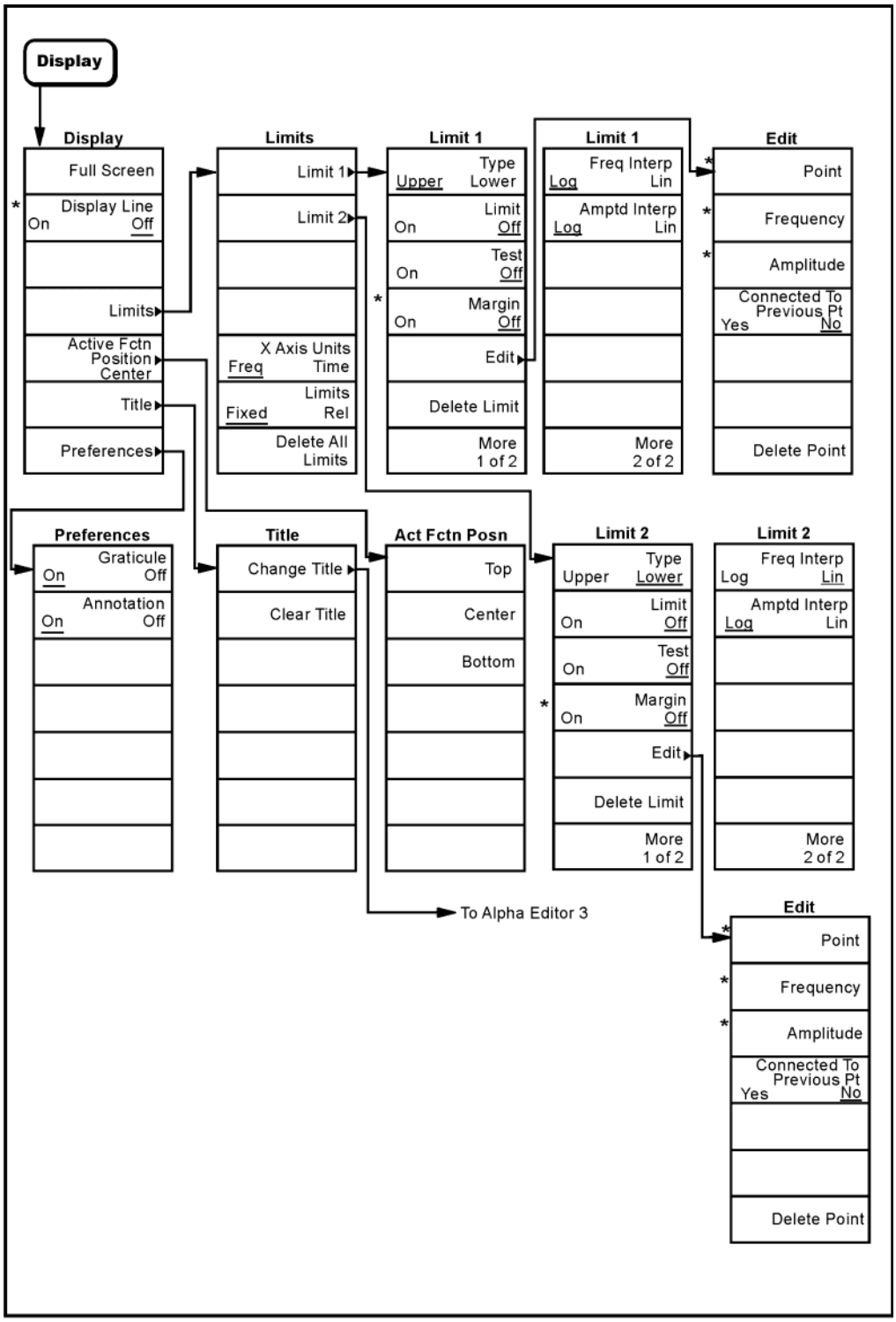
Display Menu



* An active function which allows data entry

pl798b

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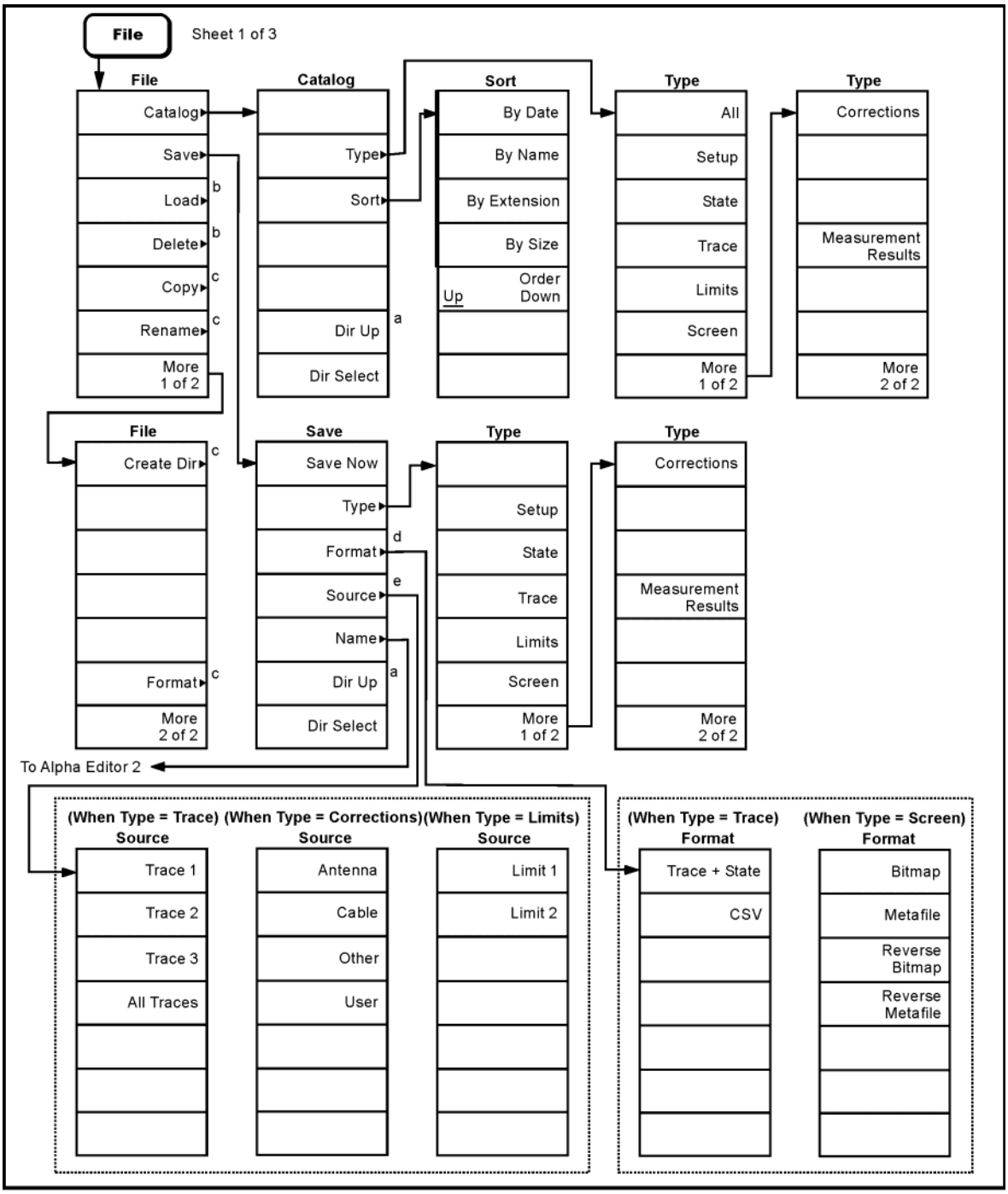
File Menus (1 of 3)



a. Grayed out if no directory selected.
b. Continued on sheet 1 of 3.
c. Continued on sheet 3 of 3.
d. Available only when **Type** is set to **Trace** or **Screen**.
e. Available only when **Type** is set to **Trace**, **Limits**, or **Corrections**.

pl761b

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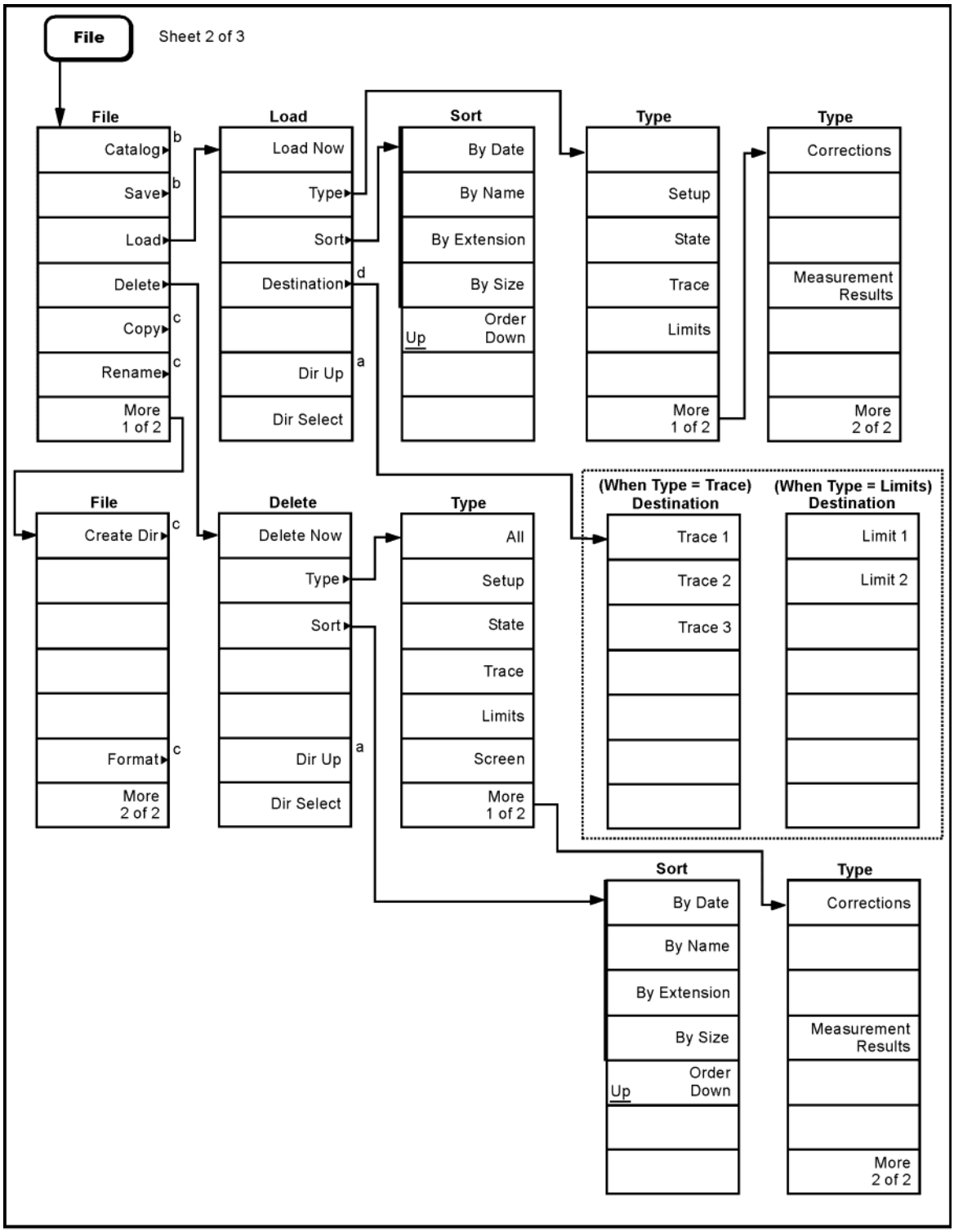
File Menus (2 of 3)



a. Grayed out if no directory selected.
b. Continued on sheet 1 of 3.
c. Continued on sheet 3 of 3.
d. Only available when **Type** is set to **Trace** or **Limits**.

pl73d

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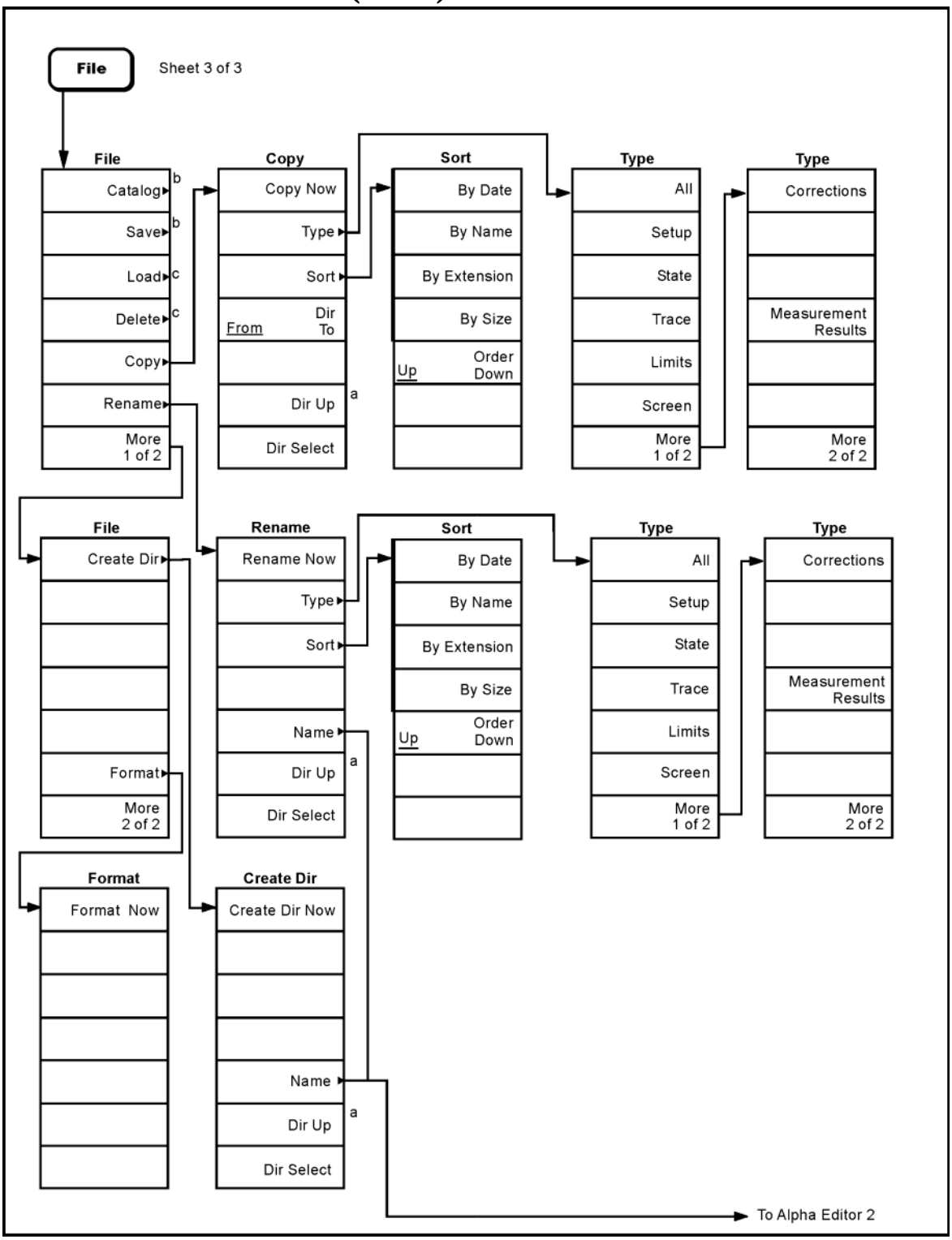
File Menus (3 of 3)



a. Grayed out if no directory selected.
b. See sheet 1 of 3.
c. Continued on sheet 2 of 3.

pl760b

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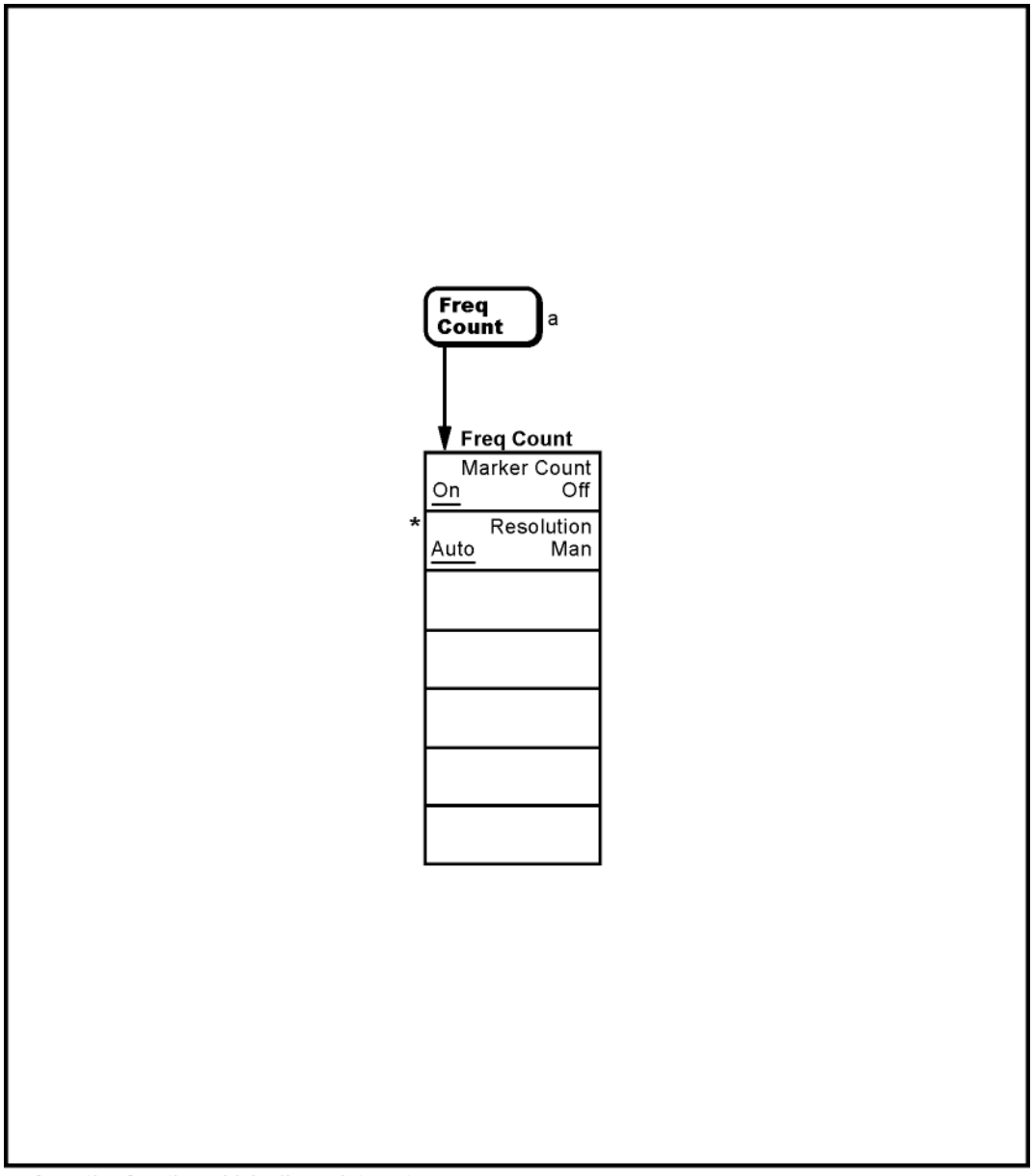
Freq Count (Marker) Menu



* An active function which allows data entry

a. Not available when **Frequency, Scale Type (Log)** is selected.

pl76

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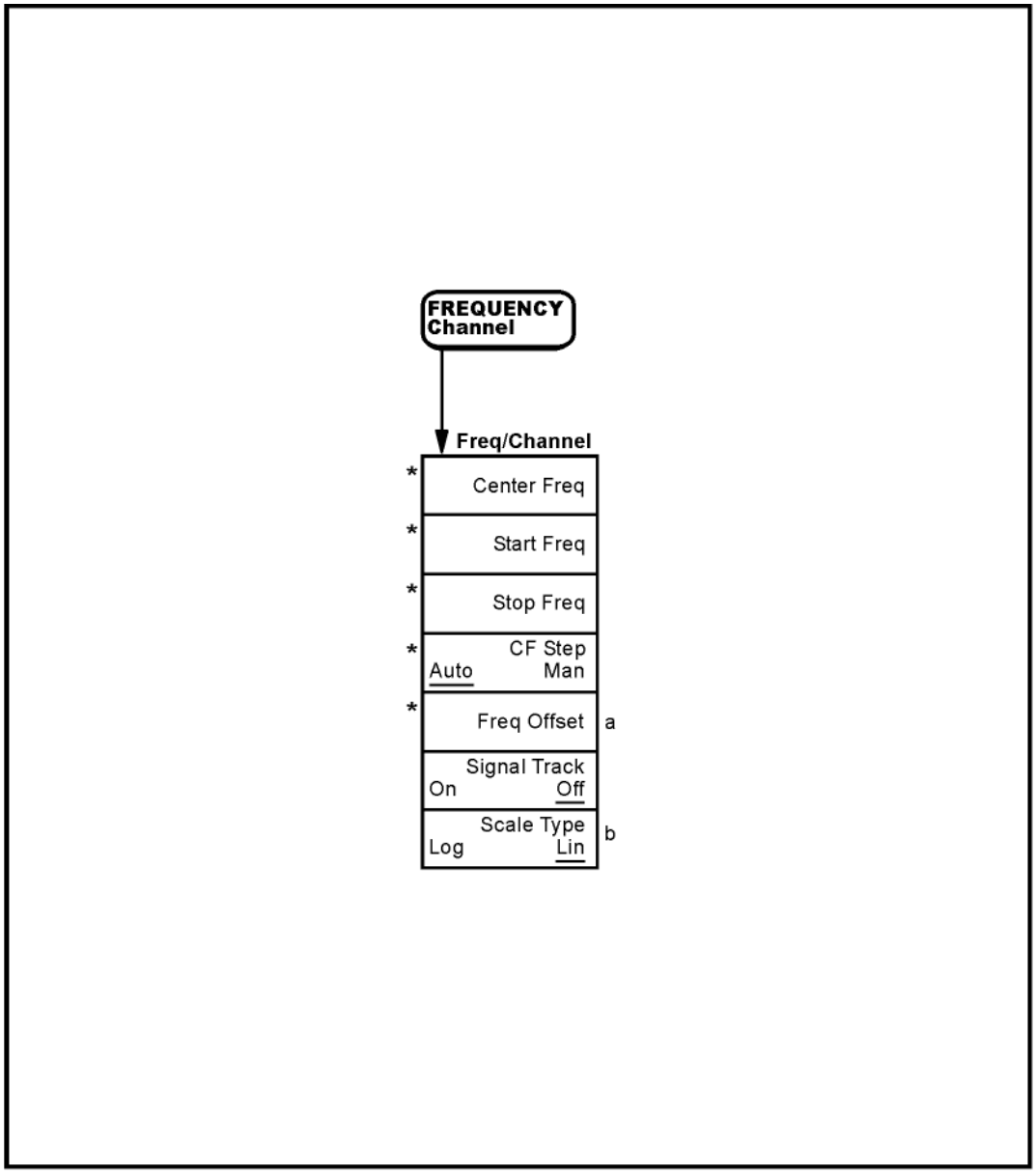
FREQUENCY Channel Menu



a. Not available when **FREQUENCY, Scale Type (Log)** is selected.
b. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
* An active function which allows data entry

pl763b

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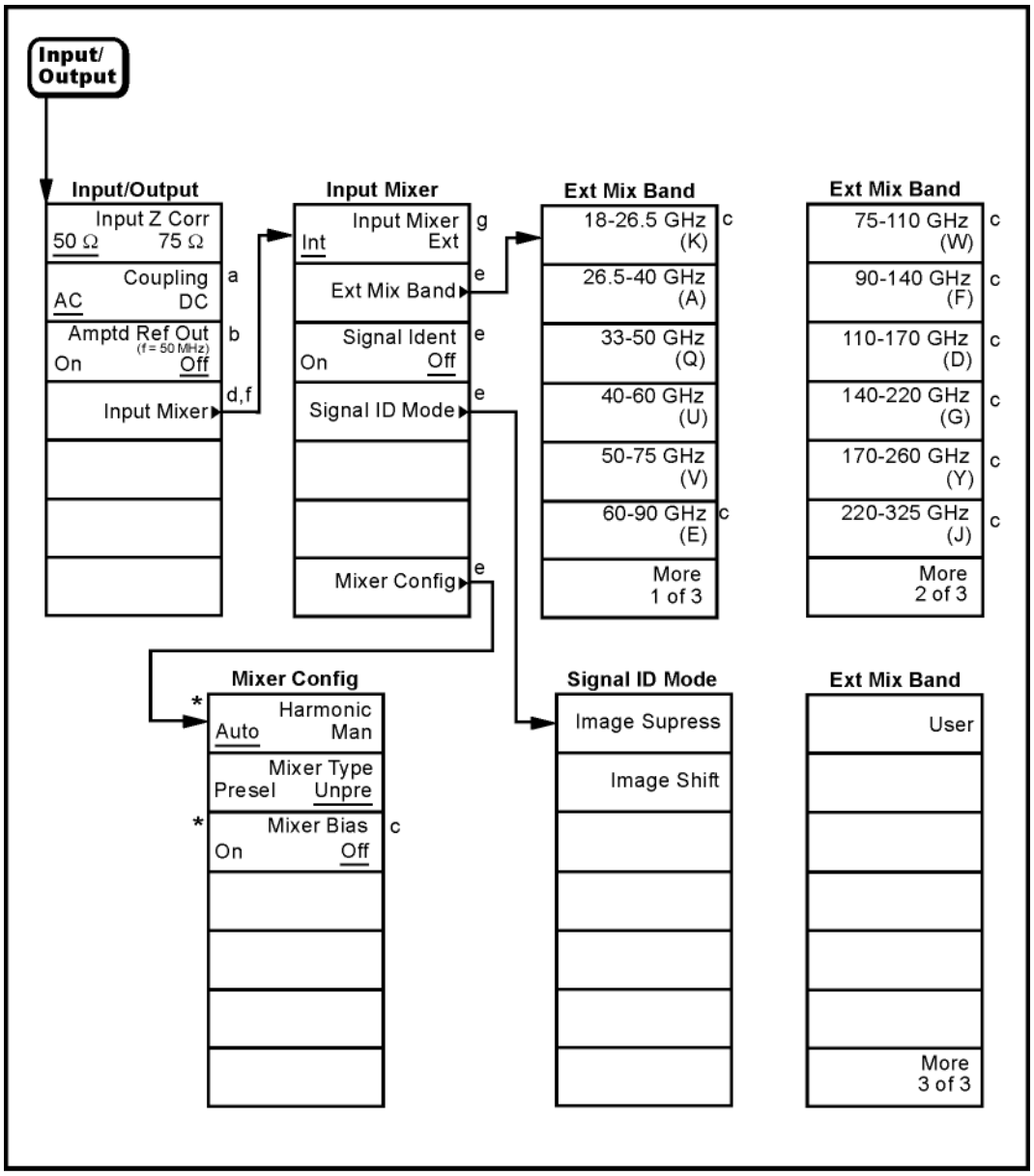
Input/Output Menu



a. Agilent E4402B or E4407B with Option UKB, E4404B, and E4405B only
b. Key label is **Amptd Ref** for E4401B and E4411B
c. Grayed out if **Mixer Type** is **Presel**
d. E4407B Option AYZ (External Mixing) only
e. Grayed out if **Input Mixer** is **Int**
f. Grayed out if the Tracking Generator is on (**Source, Amplitude (On)**) or **Internal Preamp (On)** is selected.
g. Not available when **Frequency, Scale Type (Log)** is selected.
* An active function which allows data entry

pl729b

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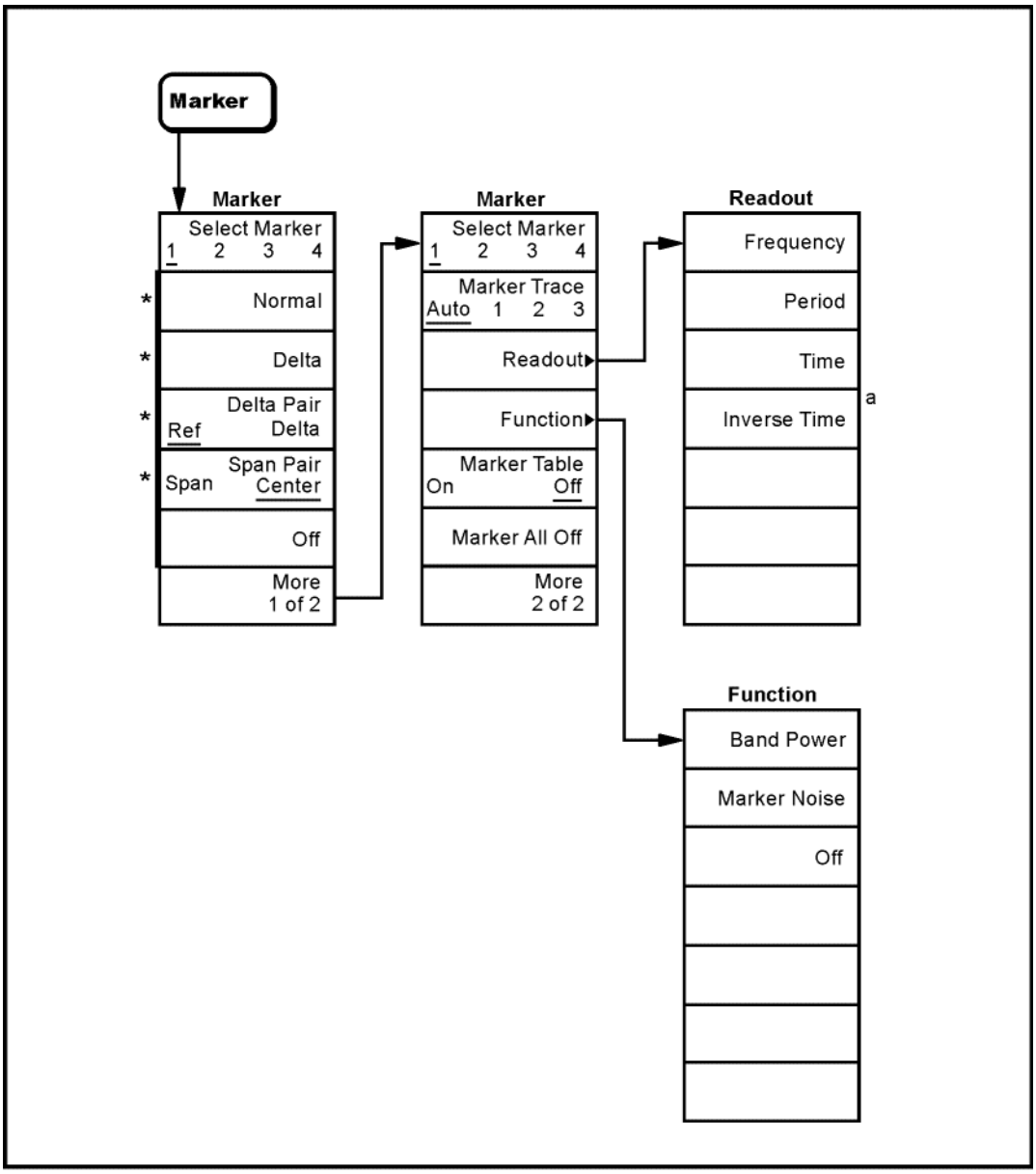
Marker Menu



a. Available in zero span with **Marker Delta** active.
***** An active function which allows data entry

pl764b

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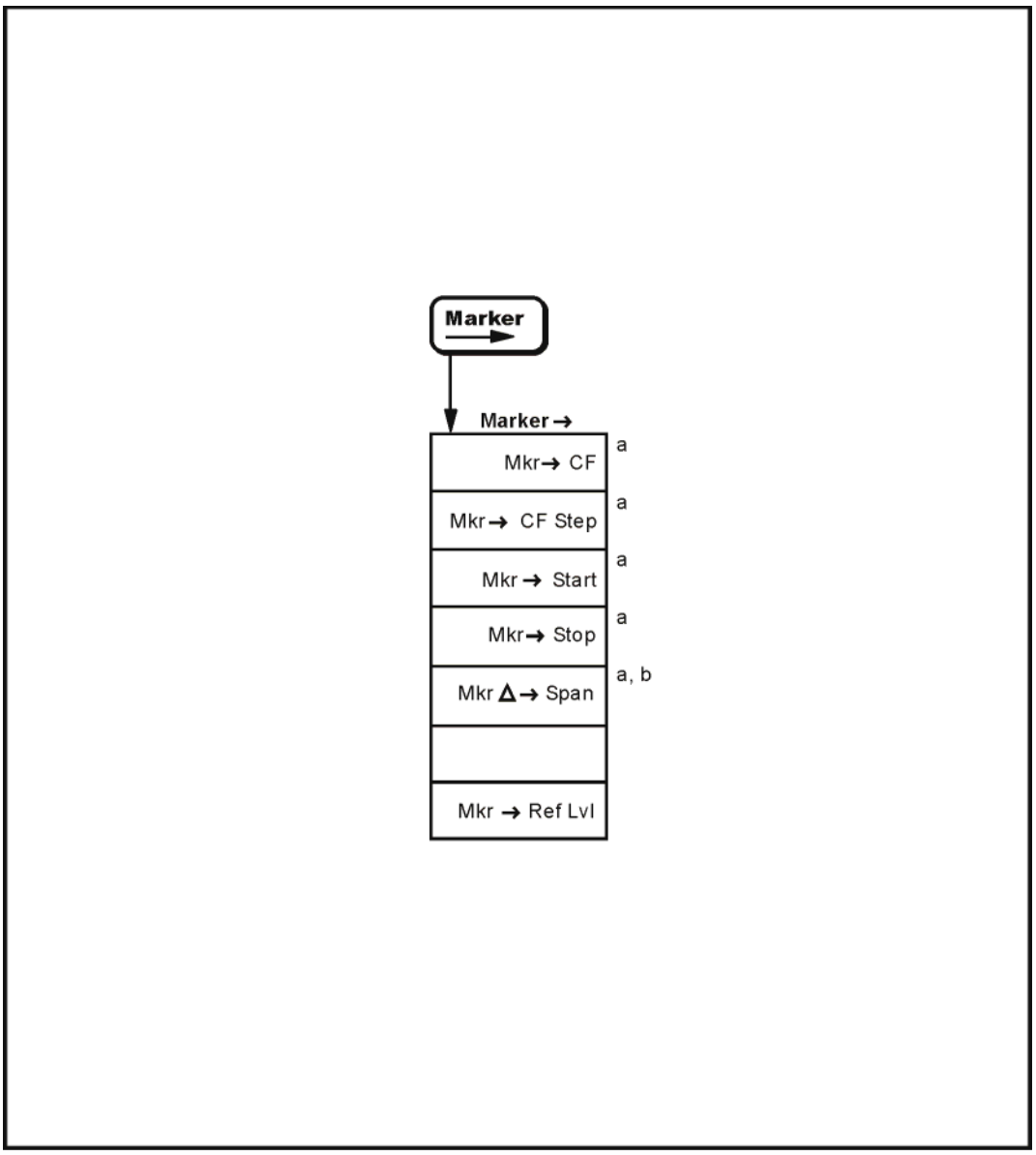
Marker → Menu



a. Not active when **span** is set to zero (Zero Span)
b. Active only when **Marker**, **Delta** is selected.

pb910a

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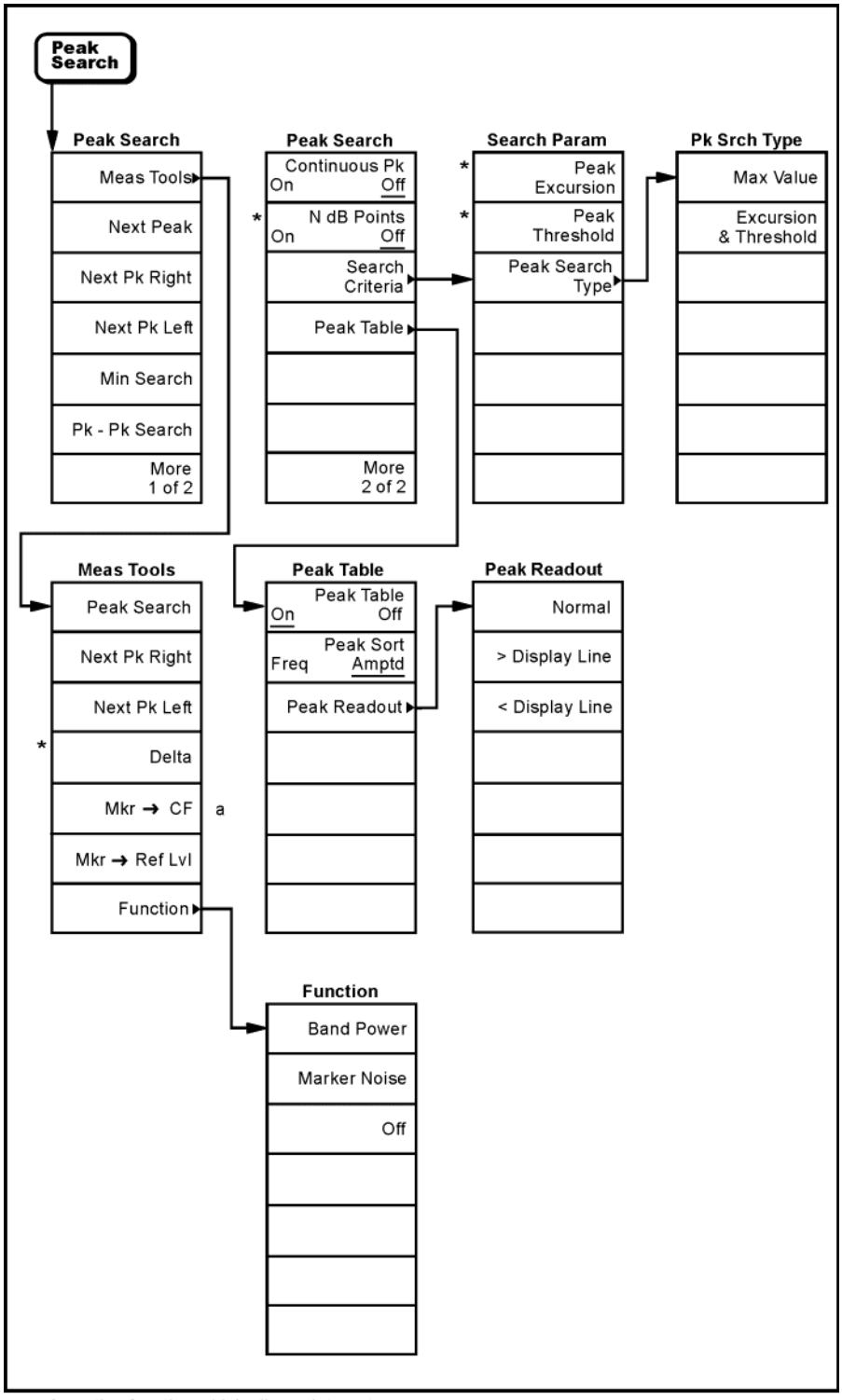
Peak Search Menu



* An active function which allows data entry
a. Unavailable in zero span

pl777b

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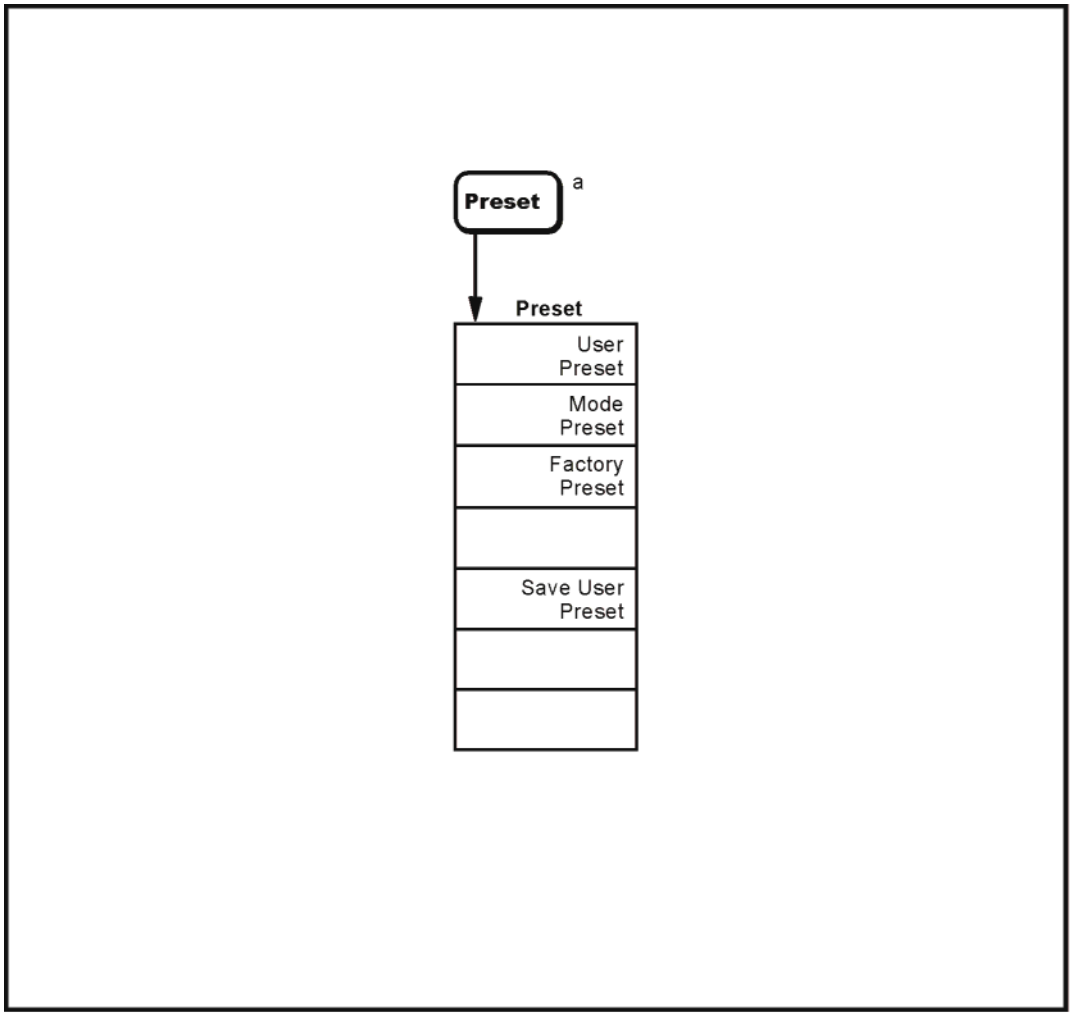
Preset Menu



a. Appears only when Preset is set to User in the **System, Power On/Preset, Preset Type** menu. Otherwise **Preset** performs a **Factory Preset**.

pl768b

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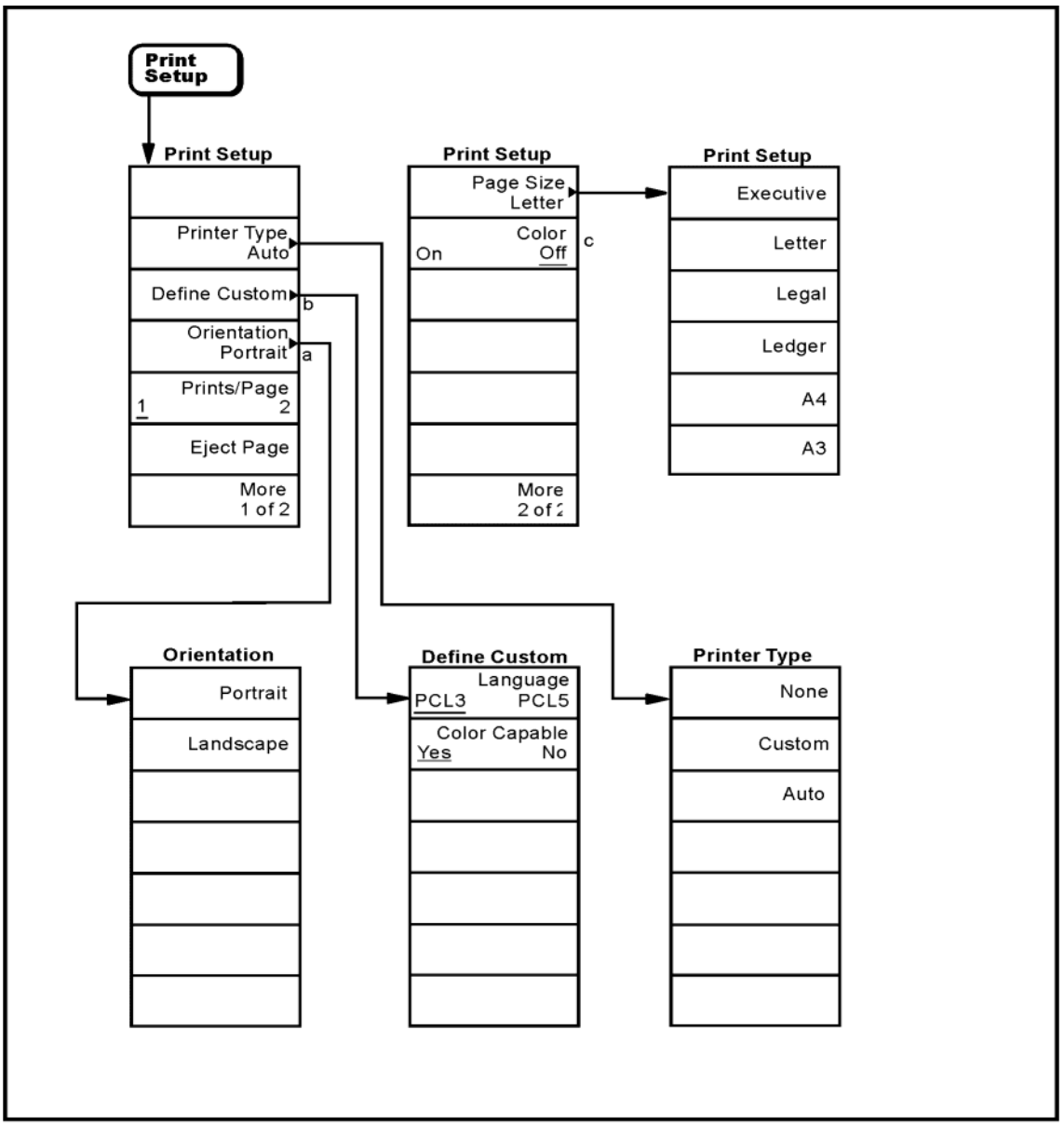
Print Setup Menu



a. Available only with PCL5 printers.
b. Grayed out unless **Custom** is selected in the **Printer Type** menu.
c. Available only with color printers.

pl792a

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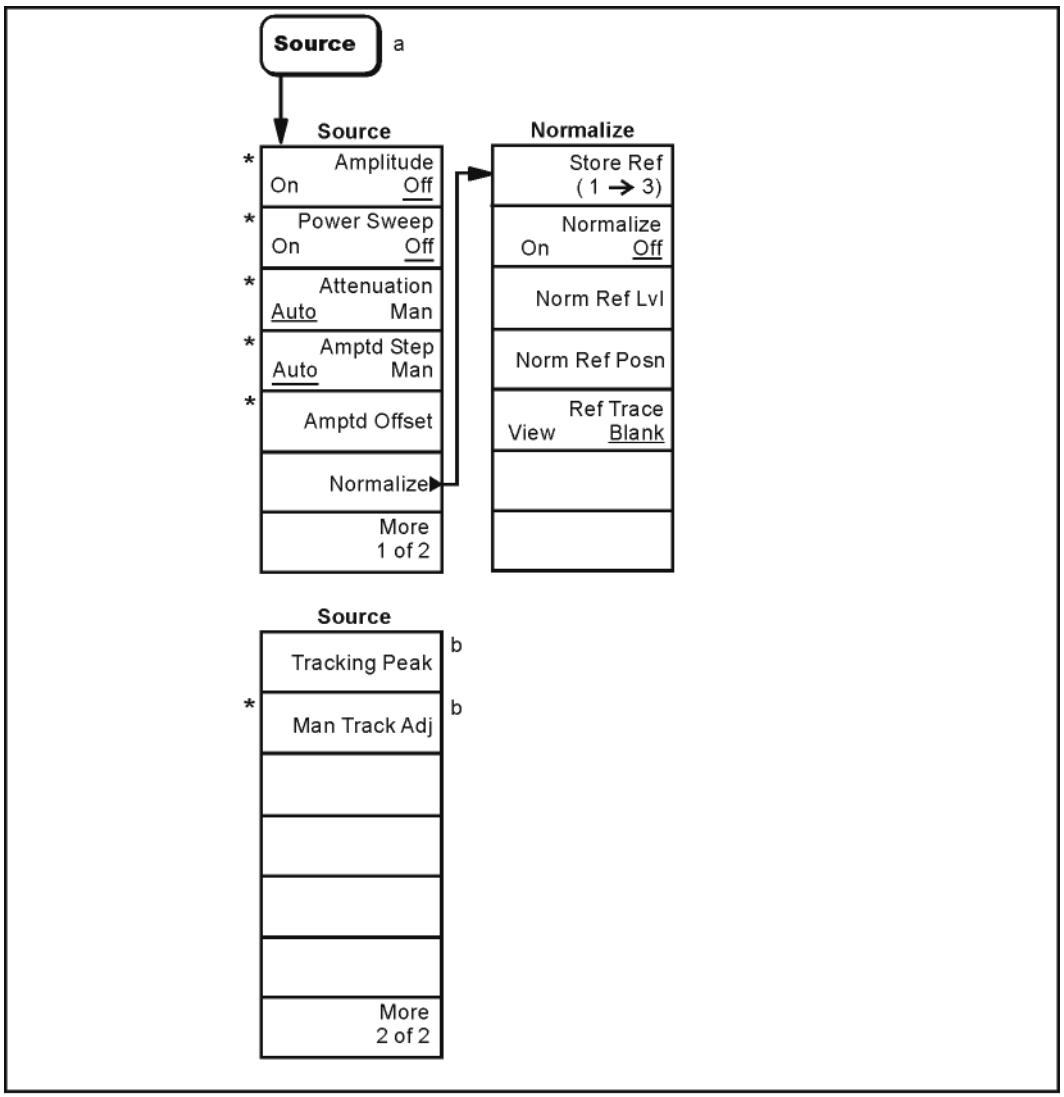
Source Menu



a. Source menu available only with Option 1DN or Option 1DQ installed
b. Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B only
* An active function which allows data entry

pl779b

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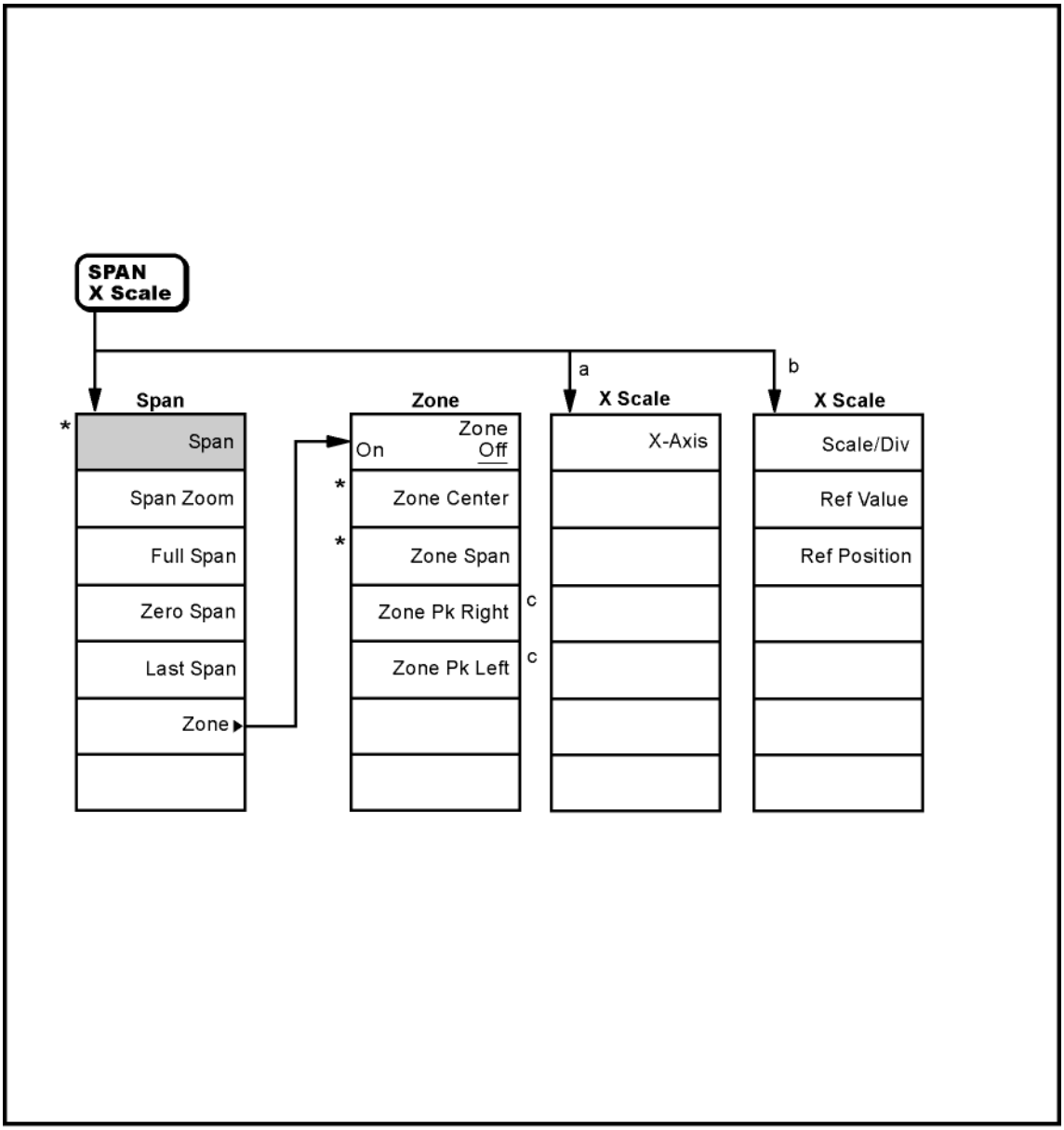
SPAN (X Scale) Menu



a. Appears only when **Power Stat CCDF** is selected in the **MEASURE** menu.
b. Appears only when **Spectrum Emission Mask** is selected in the **MEASURE** menu.
c. Available only when the upper window is active.
***** An active function which allows data entry.

pl714a

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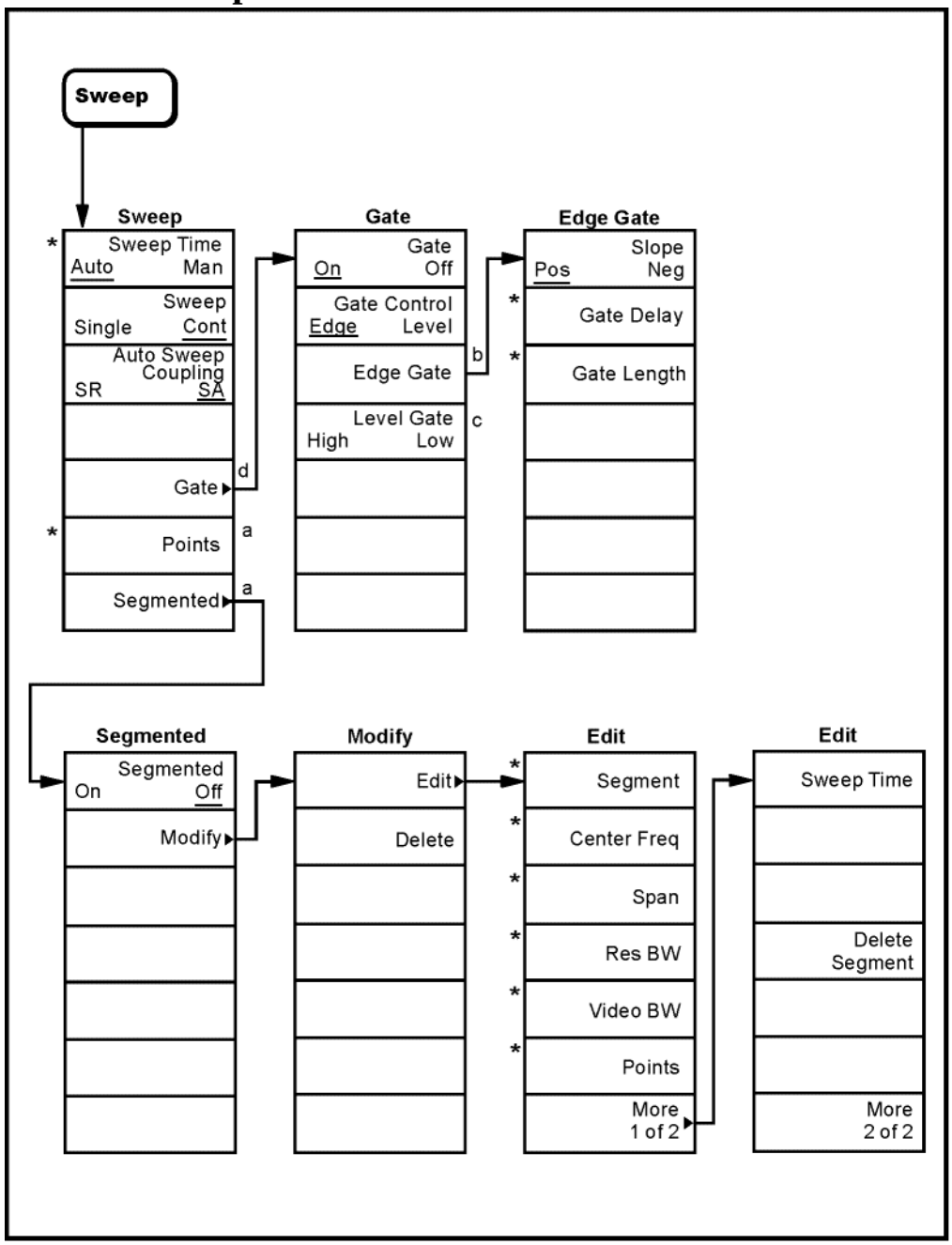
Sweep Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B and E4407B)
b. Grayed out unless **Edge** is selected as **Gate Control**
c. Grayed out unless **Level** is selected as **Gate Control**
d. Agilent ESA - E Series only with Option 1D6 (Time Gated Spectrum Analysis) (E4401B E4402B, E4404B, E4405B and E4407B)
***** An active function which allows data entry

pl769b

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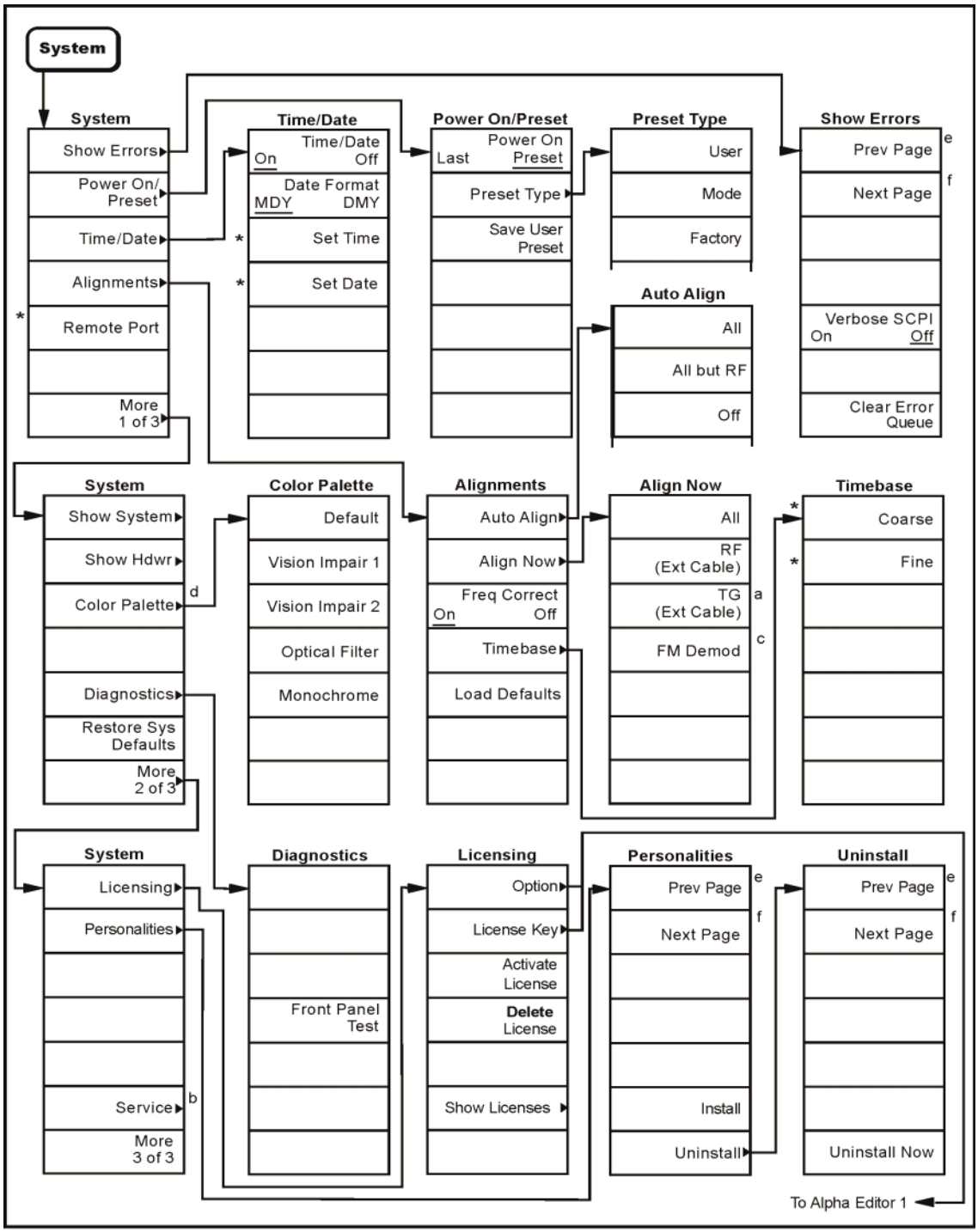
System Menu



a. Agilent E4402B, E4403B, E4404B, E4405B, E4407B and E4408B with Option 1DN only
b. For Service menus, refer to the ESA Spectrum Analyzers Service Guide
c. Available only with Option BAA (FM Demodulation)
d. Agilent ESA-E series only (E4401B, E4402B, E4404B, E4405B, and E4407B)
e. Grayed out when on the last page or if there is only one page
f. Grayed out when on the first page or if there is only one page
* An active function which allows data entry

pl774b

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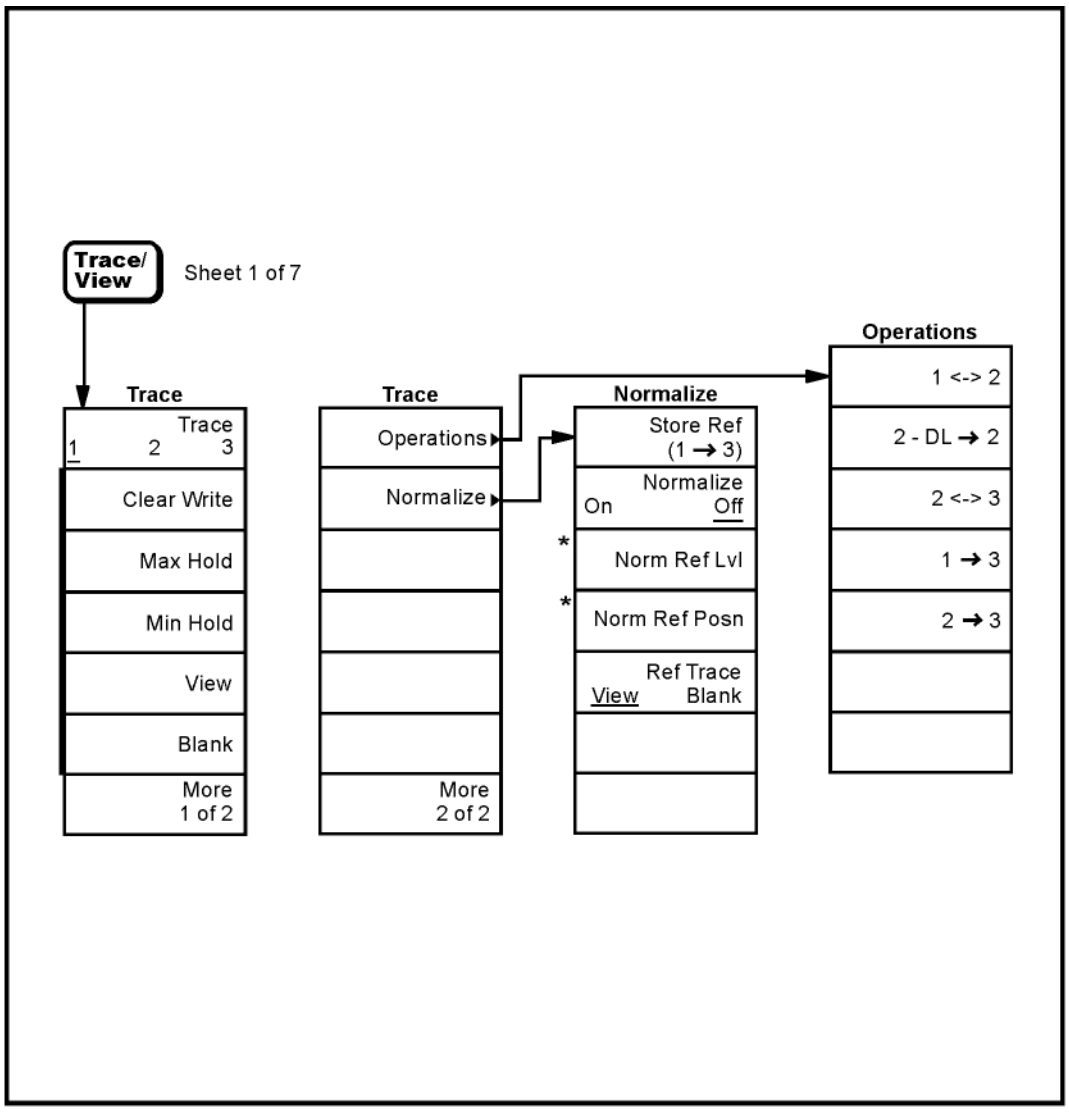
Trace/View Menu



* An active function which allows data entry

pl778b

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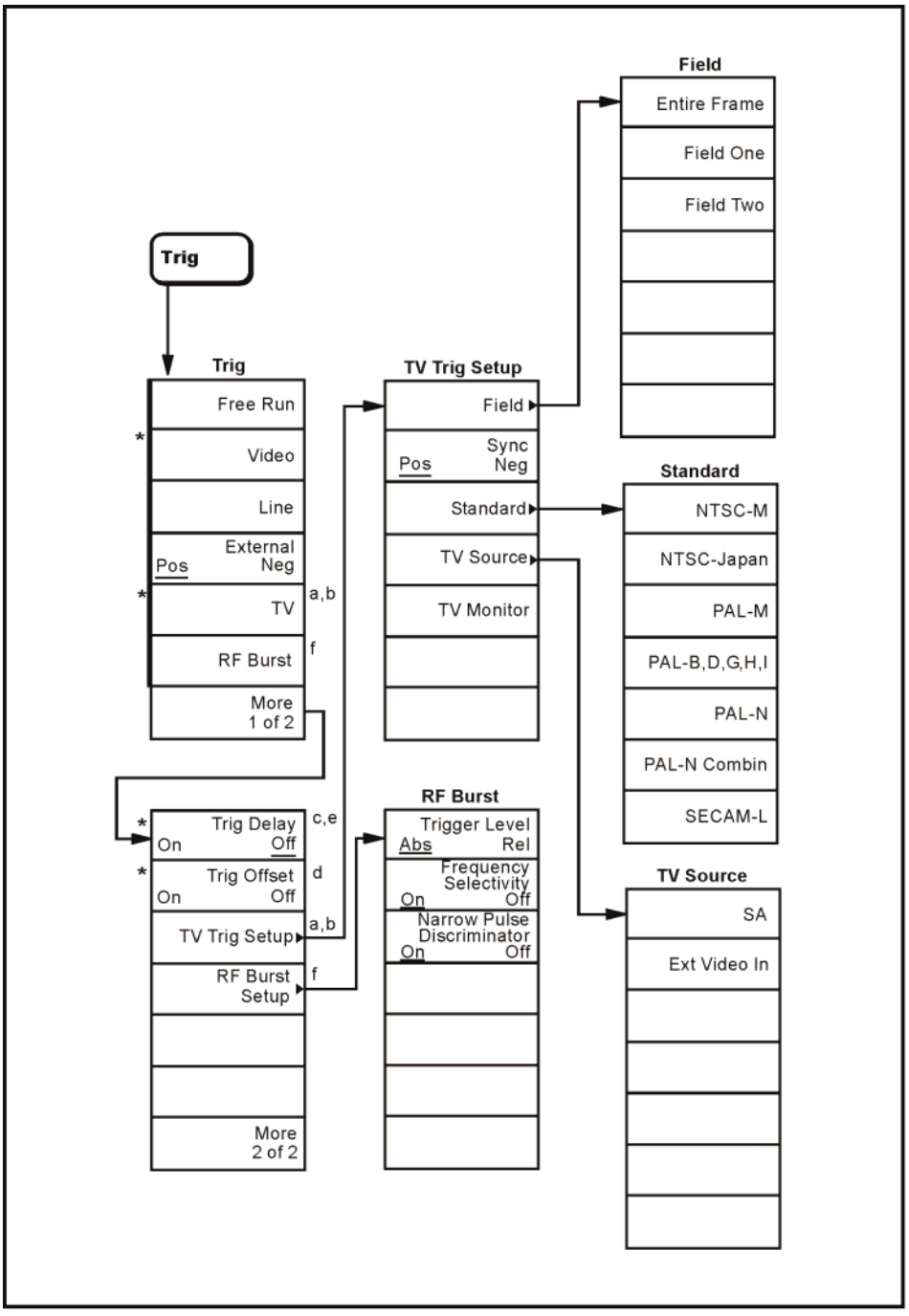
Trig Menu



a. Agilent ESA-E Series only (E4401B, E4402B, E4404B, E4405B, and E4407B)
b. Available only with Option B7B (TV Trigger and Picture on Screen) and an FM Demod option
c. Trig Delay cannot be turned on if Gate is turned on
d. Available only in zero span and in resolution bandwidths ≥ 1 kHz
e. Available only in **Line** and **External** trigger modes
f. Available only with Option B7E (RF Communications Hardware)
* An active function which allows data entry

pl772b

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